RAFFERTY-ALAMEDA PROJECT

ENVIRONMENTAL IMPACT STATEMENT

Souris Basin Development Authority

CHAPTER 1

PROJECT DESCRIPTION

RAFFERTY/ALAMEDA ENVIRONMENTAL IMPACT STATEMENT

CONTENTS

Executive Summary Report

Chapter 1 Project Description

Chapter 2 Social & Economic Circumstances

Chapter 3 Benefit Cost Analysis

Chapter 4 Public Involvement

Chapter 5 Geology & Mineral Resources

Chapter 6 Hydrogeology

Chapter 7 Hydrology

Chapter 8 Water Quality

Chapter 9 Soils

Chapter 10 Natural Vegetation

Chapter 11 Transportation

Chapter 12 Land Use

Chapter 13 Irrigation

Chapter 14 Fisheries

Chapter 15 Wildlife

Chapter 16 Heritage Resources

Chapter 17 Recreation
(a) - Recreation General
(b) - Lutheran Bible Camp
(c) - Dr. Mainprize Regional Park

Bibliography

TABLE OF CONTENTS

CHAPTER 1

PROJECT DESCRIPTION

	Page
Introduction	1
Description of Souris River Basin	2
Water-Related Problems in the Souris River Basin	4
Multiple-Objective Water Projects	13
Water Control Facilities on the Souris River in Saskatchewan	14
The Rafferty/Alameda Project	18
- Rafferty Dam and Reservoir	18
- Downstream Channelization	25
- Rafferty-Boundary Diversion Channel	30
- Alameda Dam and Reservoir	32
Planning Considerations	38
Regulatory Requirements	42
Glossary	46

APPENDICES

Appendix One - Mandate of the Souris Basin Development Authority
Appendix Two - Project Specific Guidelines

FIGURES

Figure 1(a) - Map of Souris Basin Census Divisions 1981
Figure 1(b) - Location of Rafferty and Alameda Projects
Figure 2 - Rafferty Dam General Arrangement Line "A" & Line "C"
Figure 2(a) - Rafferty Reservoir Area at 549.5 m
Figure 2(b) - Rafferty Dam and Reservoir from the East - Artist's Depiction
Figure 3 - Profile of Rafferty Reservoir
Figure 4 - Rafferty Dam - General Arrangement
Figure 5 - Rafferty Dam - Borrow Areas
Figure 6 - Rafferty Dam - Wick Drain Configuration
Figure 7 - Downstream Channelization (Souris River Channel Improvement Study)
Figure 8 - Rafferty Dam - Diversion Channel
Figure 9 - Rafferty Dam - Diversion Channel Profile
Figure 10 - Alameda Dam and Reservoir
Figure 11 - Alameda Dam - View from South
Figure 12 - Alameda Reservoir Profile
Figure 13 - Alameda Dam - General Arrangement
Figure 14 - Alameda Dam - Cross-Section

INTRODUCTION

The Souris Basin Development Authority is requesting, through this Environmental Impact Statement (EIS), a license from the Saskatchewan Department of Environment to construct the Rafferty Dam, the Alameda Dam and related appurtenances on the Souris River system in southeastern Saskatchewan. The parameters for the preparation of this Statement were established through the General Guidelines for the Preparation of an Environmental Impact Statement and the Rafferty/Alameda Project Specific Guidelines for the Preparation of an Environmental Impact Statement which were provided by the Saskatchewan Department of Environment. A copy of the Project Specific Guidelines are included in the Appendices. As a general framework for this Statement, the Souris Basin Development Authority has relied on a structure for Environmental Impact Statements proposed by the Organization of Economic Co-operation and Development in their monograph Management of Water Projects (1985) and upon reference to a number of previous Statements which have been prepared in Saskatchewan for the Department of the Environment which serve as precedents.

The Rafferty/Alameda EIS outlines the objectives of the Project and how these objectives are satisfied through the construction of these facilities on the Souris River, the positive and negative results from the Project's construction and what mitigative steps are being proposed. The EIS deals only with impacts within the Province of Saskatchewan because of jurisdictional limitations within the Boundaries of Saskatchewan. Downstream impacts including those on the Province of Manitoba are being dealt with by the U.S. Army Corps of Engineers who are completing the Souris River Basin Project: General Plan Report and Environmental Impact Statement.

Consultations have occurred between the Souris Basin Development Authority and the U.S. Army Corps of Engineers, St. Paul District Office in the preparation of the respective documents thus obviating the need for a single assessment of the entire basin. The U.S. Army Corps of Engineers have stated that the proposed project fully complies with all applicable U.S. environmental statutes and Executive Orders for the current stage of planning.

DESCRIPTION OF SOURIS RIVER BASIN

The Souris River (or the Mouse River as it is sometimes referred to in the United States) originates in the Province of Saskatchewan near Cedoux. The river flows in a southeasterly direction from its source for approximately 274 km through the communities of Weyburn, Estevan, Roche Percee and Oxbow until it crosses the International Boundary into the State of North Dakota in the United States of America. The river then flows southeast for approximately 130 km passing through the City of Minot after which it turns north and ultimately crosses the International Boundary again, this time into the Province of Manitoba, approximately 540 km from its source. The Souris then travels in a generally northeasterly direction for approximately 160 km to its confluence with the Assiniboine River. Its total length is approximately 700 km from source to mouth (see Figures 1(a) and 1(b)).

In general, the Souris River Valley is flat and shallow with an average fall of approximately .3 m per km which results in a relatively slow velocity of flow. Close to its source above the City of Weyburn, the Souris River Valley is not well defined and although sections in this reach have been improved through dredging, the river banks are low and flooding occurs. Below Weyburn, the valley has greater definition with higher banks and greater slope. Roughbark Creek joins the mainstem of the Souris River in Township 5, Range 12, W 2nd Meridian. Approximately halfway between the Cities of Weyburn and Estevan, the river valley widens and as a result of the very slight slope in this reach of the river, the river banks have risen above the adjacent flats with the result that when the banks are topped, the entire valley floods. This condition is prevalent throughout most of the Souris River between Dead Lake and the McDonald Lake area.

Below the City of Estevan, Long Creek joins the mainstem of the Souris River. Boundary Dam, constructed on Long Creek, created an industrial reservoir which provides cooling water for the Saskatchewan Power Corporation's Boundary Dam Power Station, domestic water for Estevan and limited recreational facilities.

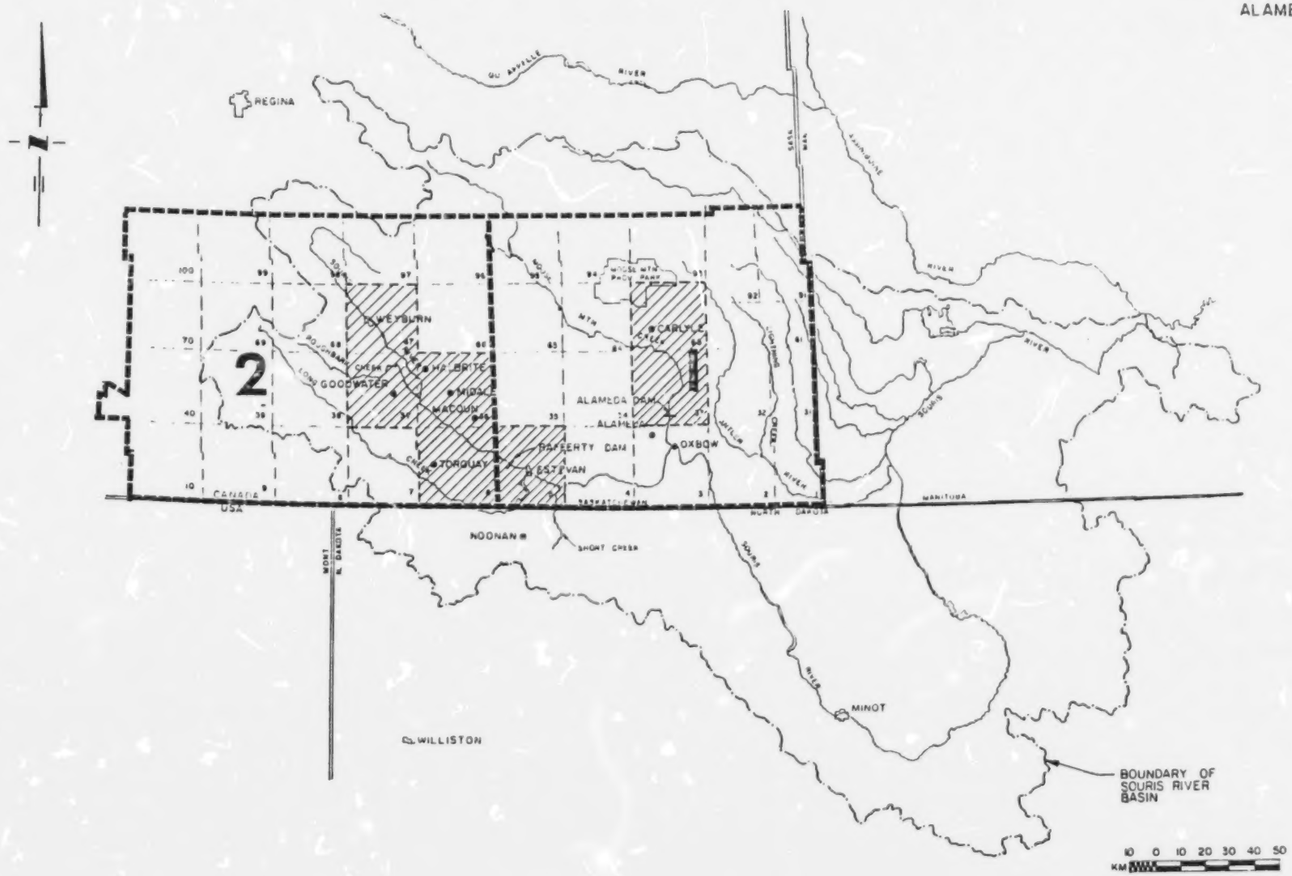
Below the confluence of Long Creek, the valley becomes steeper, the banks higher and the floodplain much less extensive than in the Dead Lake to Estevan

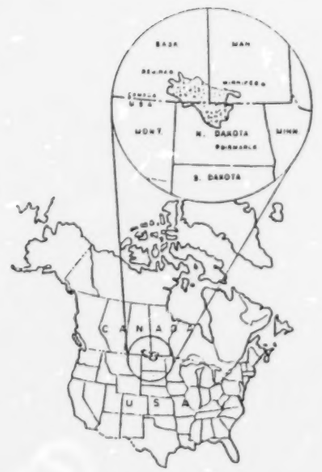
NOTES:

1. THE STUDY AREA IS CENSUS DIVISIONS 1 & 2.
2. THE PROJECT AREAS ARE CROSS-HATCHED.

RAFFERTY — RM NO. 5 ESTEVAN
RM NO. 6 CAMBRIA
RM NO. 36 CYMRI
RM NO. 37 LOMOND
RM NO. 67 WEYBURN

ALAMEDA — RM NO. 33 MOOSE CREEK
RM NO. 63 MOOSE MOUNTAIN





LOCATION PLAN

FIGURE 1(a)

DEPT	APP'D	REV

OTHER ENG. CHECKS	DRAFTING DEPT
DEPT CHK'D BY DATE	DRAWN BY GMM CHK'D BY DATE 87-04-01
DEPT CHK'D BY DATE	SCALE
DEPT CHK'D BY DATE	DESIGN DIVISION
DEPT CHK'D BY DATE	DEPT DESIGNED BY CHK'D BY APP'D BY DATE

SOURIS BASIN DEVELOPMENT AUTHORITY

RAFFERTY / ALAMEDA PROJECTS

RAFFERTY / ALAMEDA DAMS
RESERVOIR
ENVIRONMENTAL IMPACT STATEMENT
PROJECT / CENSUS DIVISIONS - 1981

PROP	UNIT	SYST	FUNC	SERIAL	REV
A43	10		RVR	00	

NOTE:
RADIAL DISTANCES FROM ESTEVAN

FIGURE I(b)

DEPT	APP'D			DEPT	APP'D			DEPT	APP'D			DEPT	APP'D			DEPT	APP'D		
																DRAFT		D.F.K.	87-05-15
			REV				REV				REV				REV				REV A

OTHER ENG CHECKS	DRAFTING DEPT
DEPT / CHK'D BY / DATE	DRAWN BY D. KOZORIZ / CHK'D BY S / DATE 87-05-15
DEPT / CHK'D BY / DATE	SCALE:
DEPT / CHK'D BY / DATE	DESIGN DIVISION: DEPT / DESIGNED BY / CHK'D BY
DEPT / CHK'D BY / DATE	APP'D BY / DATE

SOURIS BASIN DEVELOPMENT AUTHORITY

RAFFERTY / ALAMEDA PROJECTS

RAFFERTY / ALAMEDA DAMS
RESERVOIRS
ENVIRONMENTAL IMPACT STATEMENT
LOCATION OF RAFFERTY AND
ALAMEDA PROJECTS

PROP	UNIT	SYST	FUNC	SERIAL	REV
A43	1	0	RVR	00	A

reach of the river. In this stretch, the river changes direction. It flows in an easterly direction through Roche Percee until it reaches Highway 9, then turns northward to the Town of Oxbow. Between Estevan and Oxbow there are a number of areas which have good irrigation potential. At Oxbow, the Souris River is joined from the north by the Moose Mountain Creek. Below Oxbow and Glen Ewen, the river flows south and the valley widens out and becomes deeper until it passes into the United States.

The surface characteristics of the Souris River Basin are semi-arid prairie with aspen bluffs, brush and scrub in certain areas and native grasslands in uncultivated areas. Most of the Basin has been extensively cultivated and the sub-soil is generally of a gravelly nature with an over-burden of glacial deposits. The uplands adjacent to the Souris River Valley are, in general, a series of flat plains with slight undulations. These plains are trenched by the valleys of the Souris and other main streams as well as by old abandoned dry valleys.

The climate in southeastern Saskatchewan is semi-arid with annual evaporation and transpiration almost always exceeding precipitation. The average annual precipitation is approximately 420 mm and this varies widely from year to year. Periods of drought, torrential thunderstorms, excessive rainfall, deep freezes and intense heat are typical of the region's climate. Approximately 80 percent of the annual runoff that ends up in the Souris River and its tributaries originates from snow melt. Consequently, most of the runoff appears in March, April and May when high flows pose flooding problems for urban areas and agricultural land. These flows gradually diminish to zero or near zero by late summer and low soil moisture levels and drought frequently result.

Settlement in the Souris River Basin in Saskatchewan is concentrated in the Cities of Estevan and Weyburn and a number of smaller communities such as Alameda, Midale, Oxbow and Roche Percee. In recent years, rural areas have experienced a decline in population and a general move toward larger centres within the region. These trends are described in greater detail in the Social and Economic Circumstances Section of the Environmental Impact Statement.

WATER-RELATED PROBLEMS IN THE SOURIS RIVER BASIN

The history of settlement in the Souris Basin has been one of continual struggles against the vagaries imposed by the river itself. Too little water in some years, too much in others; virtually all of the water in the spring and little or none during the rest of the year. This variability in flow on the Souris River has had major implications for development in southeastern Saskatchewan. Without control structures for water storage and distribution, residents of the area have been unable to manage the available water supply to the advantage of the region and have, therefore, been subjected to every condition from flood to drought since the time the area was first homesteaded.

Scarcity of water in the region dictated that in order for a community to grow or prosper, a location near the Souris River was necessary as evinced by the location of the Cities of Estevan and Weyburn. The paradox for these and other communities and their residents has been that while the Souris River has been one of the main reasons for their location, that river has also subjected them to significant damages from floods. Flood events occur on the Souris River an average of two out of every ten years. In flood years significant damages have resulted to both households and farm units.

Water in southeastern Saskatchewan is scarce and what water there is varies widely in its flow from season to season; there is at present virtually no ability to control these flows and, as a result, elements of economic development and land use in this region differ from other areas of the province. Farms in the southeast tend to be larger, with a greater reliance on cattle and wheat farming and less development of irrigation. The Souris Basin has approximately six farms per 1,000 that irrigate compared to a provincial average of 20 per 1,000 (Saskatchewan Water Corporation, pers. comm.). This is a direct result of the relatively small amounts of surface water that currently are stored on the Souris River system and the relatively small number of major water storage projects that have been developed.

Similarly, the scarcity of water means few and crowded water-based recreation facilities for the area. High demand puts considerable stress on existing recreational developments in the Study Area and compromises capacity for effective tourism development. The quality and availability of existing

opportunities for water-based recreation arguably remains below that of other regions of Saskatchewan. Potential for competitive advantage in the tourism sector is constrained by the limited capacity of these resources.

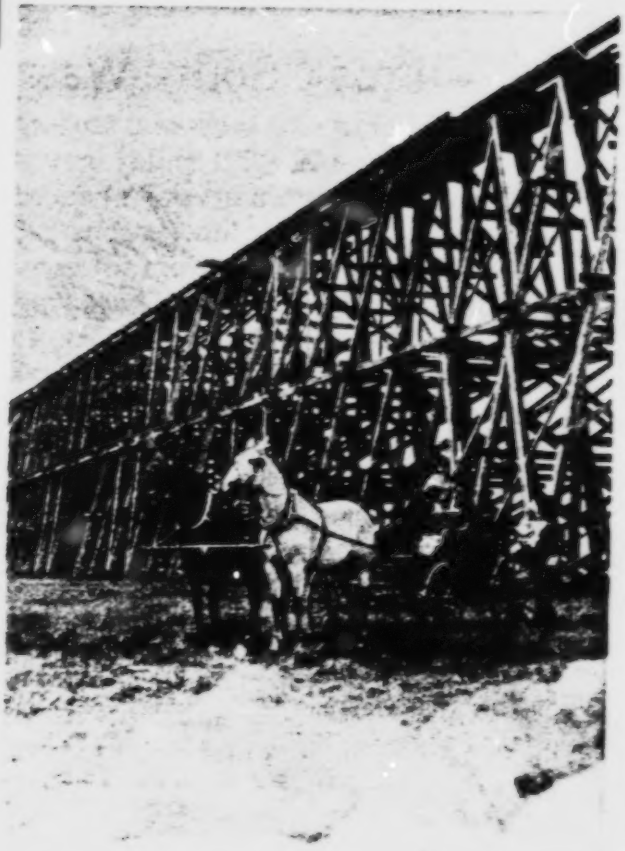
While the issues of flood damage, water scarcity, agricultural practices and water-based recreation are dealt with more extensively in quantitative terms elsewhere in this Statement, the following photographs illustrate in graphic terms what the absence of any means to manage the water of the Souris River has extracted from those who live and work in this region of Saskatchewan.

PHOTO ONE: 4 km upstream of Rafferty Dam Site, looking West. Souris River Valley, May, 1987.
(SBDA Photo)

PHOTO TWO: Souris River Valley, April 1976.Same site as above but flooded with 3 m of water;Farm Access Road and all Valley Land is completely inundated.
(Photo Courtesy Jack Muirhead)

PHOTO THREE:
Flooded Souris River Valley upstream of CPR Trestle/Rafferty Dam Site, 1985 (Main River Channel can be seen meandering through bottom of flooded valley) (Photo Courtesy Crippen Acres Ltd.)

PHOTO FOUR:
Original CPR Trestle (collapsed c. 1932) across Souris River Valley (now proposed Rafferty Dam Site)
(Photo Courtesy
"A Tale that's Told" - 1890-1980"
Estevan History Book Committee 1981)



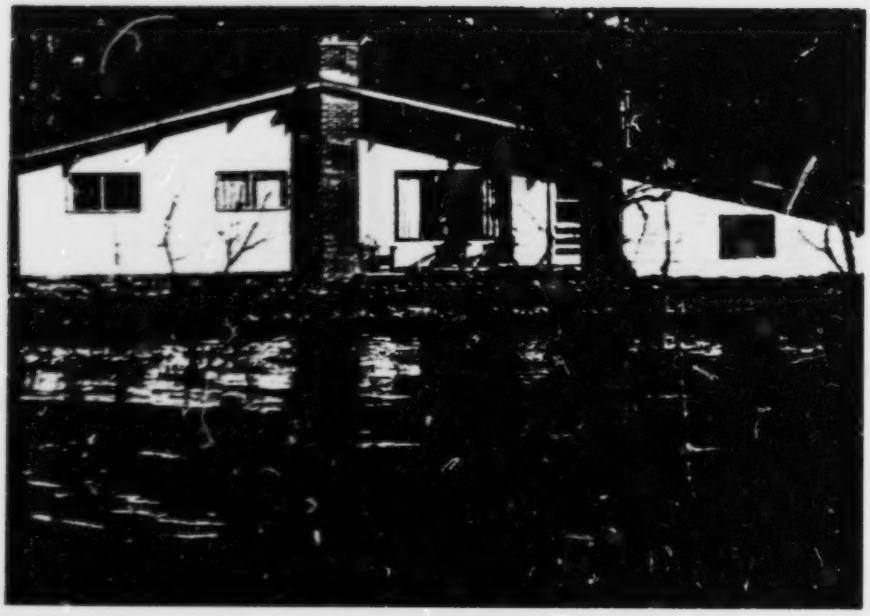


PHOTO FIVE: Souris River Flood Waters near Bridge just South of Estevan at Highway 47,1976.
(Photo Courtesy Souris Basin Development Authority)

PHOTO SIX: 1976 Flood damage at Estevan.
(Photo Courtesy Souris Basin Development Authority)

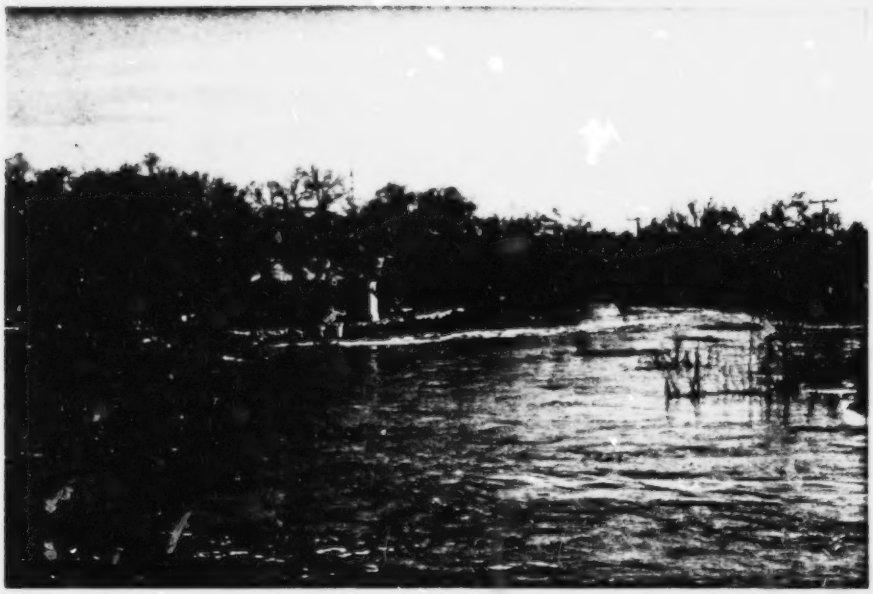


PHOTO SEVEN: Souris River Flood Waters near Bridge just South of Estevan at Highway 47,1976.
(Photo Courtesy Souris Basin Development Authority)

PHOTO EIGHT: Normal water levels on Souris River at the same location, 1976.
(Photo Courtesy Souris Basin Development Authority)

PHOTO NINE: Roche Percee 1976 Flood, damage from Souris River.
(Photo Courtesy Souris Basin Development Authority)

PHOTO TEN: Sand Bagging Souris River 1976 Roche Percee.
(Photo Courtesy Souris Basin Development Authority)

PHOTO ELEVEN: Flooding Souris River Valley, 1986; 3 km upstream of Rafferty Dam Site looking north west
(Photo Courtesy Saskatchewan Power Corporation)

PHOTO TWELVE: Flooding Souris River Valley, 1986. Note dikes along river for back flood irrigation.
(Photo Courtesy Saskatchewan Power Corporation)

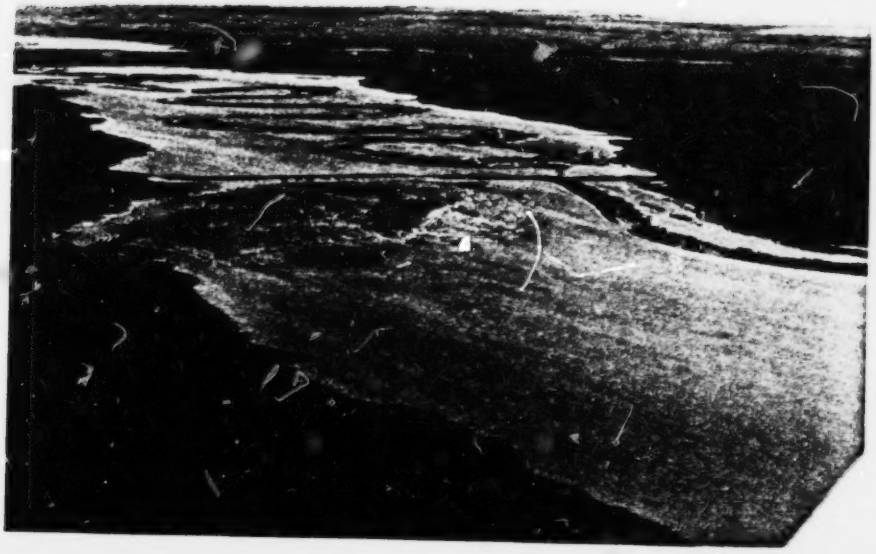


PHOTO THIRTEEN: Flooded Souris River Valley, 1986. Downstream From CPR Railway Trestle looking Northwest.
(Photo Courtesy Saskatchewan Power Corporation)

PHOTO FOURTEEN: Flooded Souris River Valley, Spring, 1986 at Rafferty Dam Site (main river channel can be seen in centre of photograph and CPR Railway grade in foreground).
(Photo Courtesy Saskatchewan Power Corporation)

MULTIPLE-OBJECTIVE WATER PROJECTS: A FRAMEWORK

Most modern water management projects are multiple objective in nature; that is, they are designed to serve several purposes. This is the case with several projects in Alberta (Oldman, South Saskatchewan River, Pekisko-Stimson) and in Saskatchewan (Lake Diefenbaker). The Organization of Economic Co-operation and Development (OECD) has acknowledged the recent increasing importance of multiple-objective water projects. In its 1985 report; Management of Water Projects, the OECD notes that the multiple objective nature of water projects results from four main factors:

i) the nature of the demands by users for different combinations of water outputs;

ii) the economics of scale that result from building larger projects,

iii) the technical complementarities that can exist between the processes for producing the different outputs; and

iv) the possibilities of risk pooling that are open by the existence of several outputs; (the opportunity to offset or manage a shortfall in one area by increasing proportionately potential gains in the objectives of another).

While not an all-encompassing enumeration, multiple objective water projects can have the following purposes:

- water related recreation
- flood control
- management of flows for water quality control
- wildlife and fish management and enhancement
- urban water uses (industrial and residential)
- generation of electricity
- irrigation.

In recognizing that a single water management project can, at least in part, fulfill these objectives, it is important to note that the first essential step toward collective action is stimulated either by the perception of a problem or through the identification of an opportunity to change the current state of affairs in a favorable way (OECD, 1985). Generally problems are initially perceived at the local level as area residents are forced to confront the realities of uncontrolled

water flows. Whatever the origin, multiple objective water projects, because of their inherent interdependency and hence complexity, are difficult to measure in terms of conventional cost-benefit terms. The OECD has noted this, "it is important to keep in mind that multiple objective procedures are used because of our inability to place monetary value on all relevant impacts of water projects. Thus multiple-objective planning raises the problem of the tangibility of economic, environmental and social impacts" (OECD, 1985).

This characteristic of multiple-objective water projects was noted in Saskatchewan some time ago. When speaking about the possibility of constructing the Gardiner Dam on the South Saskatchewan River, the then Premier of the Province of Saskatchewan, T.C. Douglas, noted:

> *"This project will mean a great deal to Saskatchewan in terms of crop diversification through irrigation, the generation of hydroelectric power, the provision of adequate water supplied....flood control and recreational benefits."*
> *"The....Project is multipurpose. Neither the electricity, nor the irrigation, nor the water supply made available would be sufficiently valuable alone to warrant the cost of construction. But together they make it worthwhile."*
>
> (Regina Leader Post, 1957)

WATER CONTROL FACILITIES ON THE SOURIS RIVER IN SASKATCHEWAN: AN OVERVIEW

For many years, water control facilities on the Souris River in Saskatchewan have been considered as a means of alleviating some of the problems noted above. Historical research has uncovered a number of references to the possibility of constructing a dam near Estevan. One reference in an edition of the Regina Leader Post in 1936 noted that construction of dams on the Souris River was to begin next year (1937). While the droughts of the 1930's brought about the creation of the Prairie Farm Rehabilitation Administration (PFRA) which resulted in the construction of many water control facilities on the Prairies, the Souris River was not one of their targets.

Developments on the Souris River, notwithstanding its location in one of the driest areas of Saskatchewan, have lagged behind those on rivers in other areas of the Province. In its Report to the International Joint Commission Souris River

Reference in 1955, the Government of Saskatchewan noted the primary reason for the slow development on the Souris River in Saskatchewan.

> *About the time the PFRA was really getting into the development and construction stage of its program, World War II started in 1939 and its activities were consequently curtailed. When the War ended, development was resumed at a greatly accelerated pace, except in the Souris River Basin. This was entirely due to the Order of the Commission (IJC), issued in the intervening period of the War, limiting Saskatchewan to 1,000 acre feet for small domestic use only....water rights for these small developments as well as the larger projects, have had to be withheld due to the Commission's Order. The result is that farmers of the Souris River Basin have been denied the use of water for irrigation to which they consider they are entitled by provincial laws.*
>
> Source: Province of Saskatchewan; Report on the Souris River Reference before the International Joint Commissions, 1955.

Throughout the remainder of the 1950's and the 1960's, water control structures were considered for the Souris River. In the late 1950's, the PFRA examined sites on the Moose Mountain Creek for the possible construction of a dam. Later, in the 1960's, PFRA, as part of the Nelson River Basin Study, conducted pre-feasibility analysis of possible dam sites along the Souris River including a site at Rafferty and at Alameda on the Moose Mountain Creek.

While area residents of southeastern Saskatchewan continued to press for water-management on the Souris River, the next major event which focused on the issue was the Souris River Basin Study in the 1970's. At the time the Study was announced, the Saskatchewan Minister of Environment, Neil Byers noted:

> *Speaking for Saskatchewan, the Souris River Basin has been the subject of more theoretical development than any other river basin in our province. Development has been advocated by every political party. Development has been favoured by every government formed by such parties. Development has been boosted by every municipal government and by almost every voluntary organization.*
>
> *This interest in development comes naturally to the people of the Souris. The Basin not only contains valuable agricultural land, but has within its borders great deposits of fossil fuels and recreation areas located close to*

relatively concentrated markets and population areas.

The big barrier which has continually loomed before every Souris development has been water. Most years enough water sluices through the Souris to more than cope with existing local needs and more than meet our international and interprovincial commitments. But there have been years of virtually zero flow. The immediate problem is to ensure a regular supply of water in the face of wide variations in flow during the year and from year to year.

(Estevan, Sask. Monday, October 28, 1974)

One of the primary results from the Souris River Basin Study was the local impetus for water storage on the Souris River and in particular, the construction of a large dam at a site known as Rafferty northwest of the City of Estevan. Notwithstanding this local sentiment, the Souris River Basin Study concluded the cost of constructing a dam at this site could not be justified without a major industrial use. It appeared that, once again, history was to repeat itself and that water management on the Souris River in Saskatchewan would remain just a dream.

In the early and mid 1980's, certain events combined to present a window of opportunity which would permit an economically viable means of constructing dams on the Souris River System. First, the Government of Saskatchewan had placed a major emphasis on the development of water-based resources as a means of economic diversification, primarily through the efforts of the newly-formed agency, the Saskatchewan Water Corporation. Second, Saskatchewan Power Corporation (SPC) began looking at various alternatives for meeting future electricity demands and decided that a thermal electric generating station at a site called Shand near Estevan would provide the most economical means of satisfying these needs. SPC then began looking at the Rafferty Reservoir as a possible source for cooling water for the Shand Power Station thus providing the major required identical component to the Project identified as a prerequisite in the Souris River Basin Study. Third, the United States was searching for the means to acquire 100 year flood protection for the City of Minot. These three factors thus combined to provide the impetus and the right set of conditions to enable the Government of Saskatchewan to begin the planning process for construction of a multiple-objective water management facility on the Souris River in Saskatchewan.

Considerable feasibility analysis was conducted by Saskatchewan Water Corporation and Saskatchewan Power Corporation in the early 1980's on the Rafferty Dam. Saskatchewan Water Corporation focused on the overall availability of water in

the Souris River and its potential uses particularly insofar as irrigation was concerned. For its part, Saskatchewan Power Corporation engaged consultants to determine how the water from the Souris River could best be used to cool the Shand Power Station.

Saskatchewan Power Corporation also began the process of acquiring baseline data required in order to comply with the Environmental Impact Requirements of Saskatchewan Environment. At this pre-feasibility phase of the project (1983-1985) the Alameda Dam and Reservoir was not considered as extensively as was Rafferty, primarily because of the relatively recent interest expressed by the United States in acquiring flood control benefits from sites in Canada.

Negotiations then began with the U.S. Army Corps of Engineers, the North Dakota State Water Commission and the City of Minot. It became clear fairly early on in these negotiations that U.S. interest in the Project stemmed from its desire to acquire 1:100 year flood protection for the City of Minot at the lowest possible cost. Various options for impoundment of water had been explored in the U.S. in the 1970's and dismissed for various reasons. The Rafferty/Alameda option presented the U.S. with the least cost means of acquiring this level of flood protection while, at the same time, providing the Province of Saskatchewan with the means of cost-sharing a project it wanted to build and consequently reduce its potential costs by almost 50%. The United States indicated its willingness to pay the equivalent of $41.1 Million U.S. (October 1985$) or approximately $57.5 Million Cdn (October 1985$) as its share of the estimated $120 Million Cdn (October 1985$) project costs. Discussion had progressed on the value of the benefits to the United States from the Rafferty and Alameda Dams until a point in late 1985 when the feasibility analysis, noted above, and the U.S. financial contribution appeared to be sufficiently firm to permit a conditional announcement to proceed with the Rafferty-Alameda Project.

On February 12, 1986, Premier Grant Devine announced that, subject to compliance with all environmental and regulatory approvals, and the successful completion of negotiations with the U.S., it was the intention of the Government of Saskatchewan to proceed with the construction of the Rafferty and Alameda Dams. In recognition of the fact that the Project would be multiple-objective in nature and would require strong co-ordination of various private sector consultants and government departments, the Souris Basin Development Authority was created. A Crown

Corporation, the Authority has as its mandate, the responsibility for the planning and building of all facilities associated with the Project (See Appendix 1).

THE RAFFERTY-ALAMEDA PROJECT

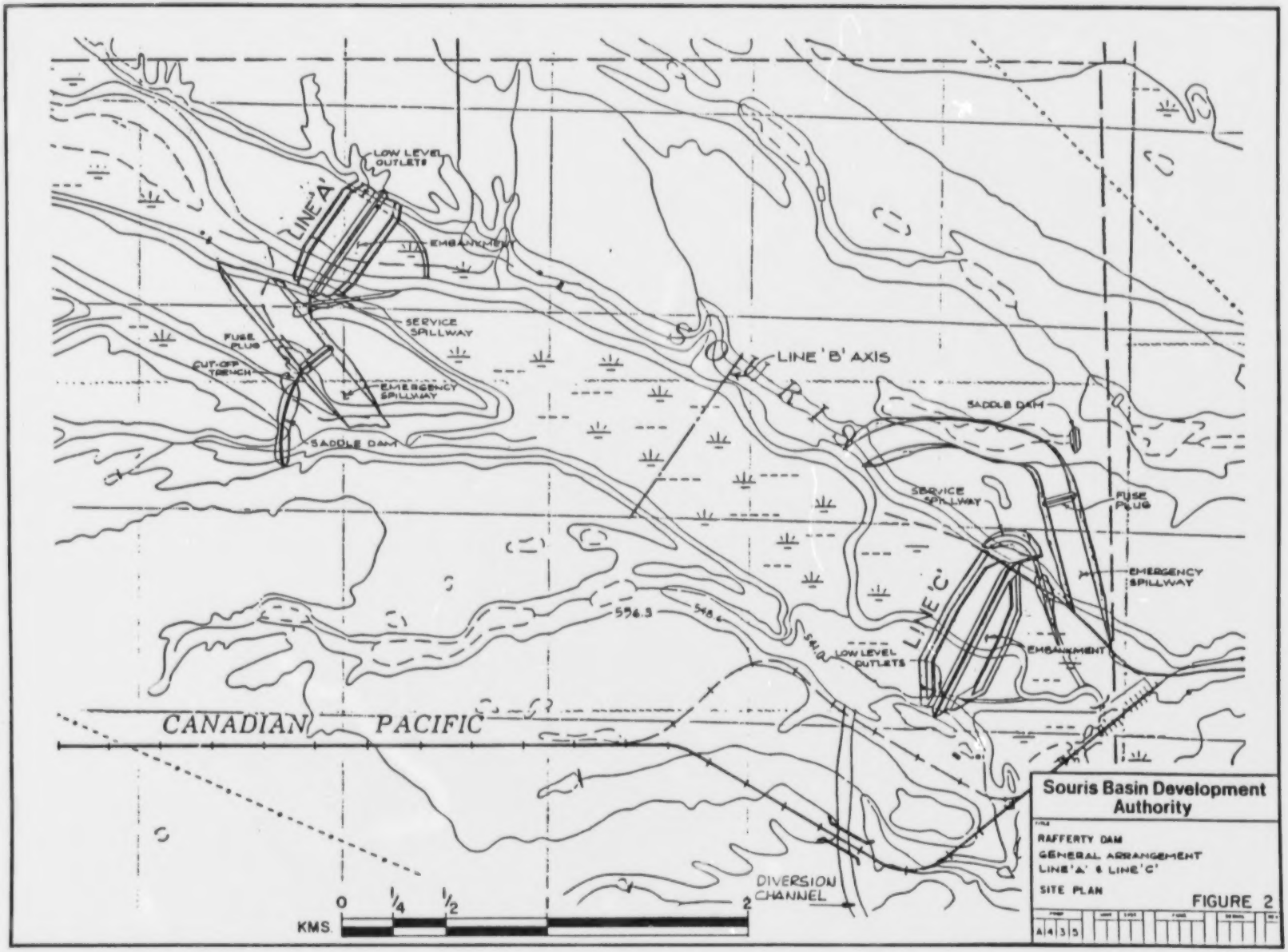
The Government of Saskatchewan, through the project proponent, the Souris Basin Development Authority, proposes to construct the Rafferty Dam on the mainstem of the Souris River six km northwest of Estevan; a drainage channel connecting Boundary Reservoir with Rafferty Reservoir; downstream channelization from the Rafferty Dam site to the Shand Power Station; and the Alameda Dam on the Moose Mountain Creek north of Oxbow.

I. RAFFERTY DAM AND RESERVOIR

A. General Description

Initial pre-feasibility studies for the Rafferty Dam had the preferred location for its placement at a site referred to by PFRA as Line A approximately 10 km northwest of Estevan. Subsequent analysis indicated poor foundation conditions present at this location along with a number of other drawbacks including severe impact of the reservoir on critical wildlife habitat, agriculture, oil field production and the cost of constructing the Boundary-Rafferty Diversion Channel.

Additional field surveys and geotechnical investigations identified another possible site 4 km closer to the City of Estevan (Figure 2). This location had a number of advantages over Line A, among which were the following: greater recreational potential because of closer proximity to Estevan, $20 Million reduction in the cost of the Boundary-Rafferty Diversion Channel, less impact on critical wildlife habitat, agriculture and pasture lands and on the Weyburn oil field in the upper reaches of the Reservoir. To this end, the major net effect of the movement of the Rafferty Dam from Site A to a location near the former CPR trestle, referred to as Site C, was to reduce the maximum controlled flood level by one full


LOW LEVEL OUTLETS
LINE 'A'
EMBANKMENT
SERVICE SPILLWAY
FUSE PLUG
CUT-OFF TRENCH
EMERGENCY SPILLWAY
SADDLE DAM
SOURIS
LINE 'B' AXIS
SADDLE DAM
SERVICE SPILLWAY
FUSE PLUG
EMERGENCY SPILLWAY
LINE 'C'
EMBANKMENT
LOW LEVEL OUTLETS
596.3
548.6
544.0
CANADIAN PACIFIC
DIVERSION CHANNEL
0
1/4
1/2
2
KMS.
Souris Basin Development Authority
RAFFERTY DAM
GENERAL ARRANGEMENT
LINE 'A' & LINE 'C'
SITE PLAN
FIGURE 2
A4 3 5

metre from 555 m to 554 m and the Full Supply Level from 551.5 m to 550.5 m. Due to the extremely flat nature of the valley floor in the upper reaches west of Halbrite, this one metre reduction meant a considerable saving of agricultural land.

The Rafferty Dam will be built on the mainstem of the Souris River at a location first identified by PFRA known as Site C approximately 6 km northwest of Estevan (see Figures 2a and 2b). The Dam and the Reservoir it creates will have a number of benefits. First, it will allow greatly enhanced recreation opportunities for southeastern Saskatchewan through the development of park facilities, cottages and additional water-based recreation. Second, the Reservoir will provide cooling water for two units at the Shand Power Station (see Planning Considerations below). Third, the Rafferty Reservoir will provide, for certain species, enhanced wildlife development potential. Fourth, the Rafferty Reservoir will provide water for the irrigation of 2,023 ha (5,000 acres) in the valley downstream of the Dam. Fifth, there will be considerable flood protection for the downstream communities of Estevan, Roche Percee and Oxbow as well as providing flood protection for North Dakota and the City of Minot. The Rafferty Reservoir will have a Full Supply Level (FSL) of 550.5 m (above sea level) and a Maximum Flood Level (MFL) of 554 m. In order to allow for the depletion of the oil reserves in the upper reaches of the Rafferty Reservoir, the reservoir will be operated with an Initial Operating Level of 549.5 m. After these resources have been depleted, (currently estimated at 20-25 years), the 549.5 m level will no longer apply and the reservoir will be permitted to reach 550.5 m (see Planning Considerations below).

At Initial Operating Level (549.5 m), Rafferty Reservoir will have a surface area of 4,600 ha, a length of 56 km, and a volume of 394,000 dam^3. At Full Supply Level (550.5 m), the Reservoir will have a surface area of 4,900 ha, a length of 57 km and a volume of 443,000 dam^3. At Maximum Flood Level (554.0 m), Rafferty will have a surface area of 6,200 ha, a length of 62 km and a volume of 630,000

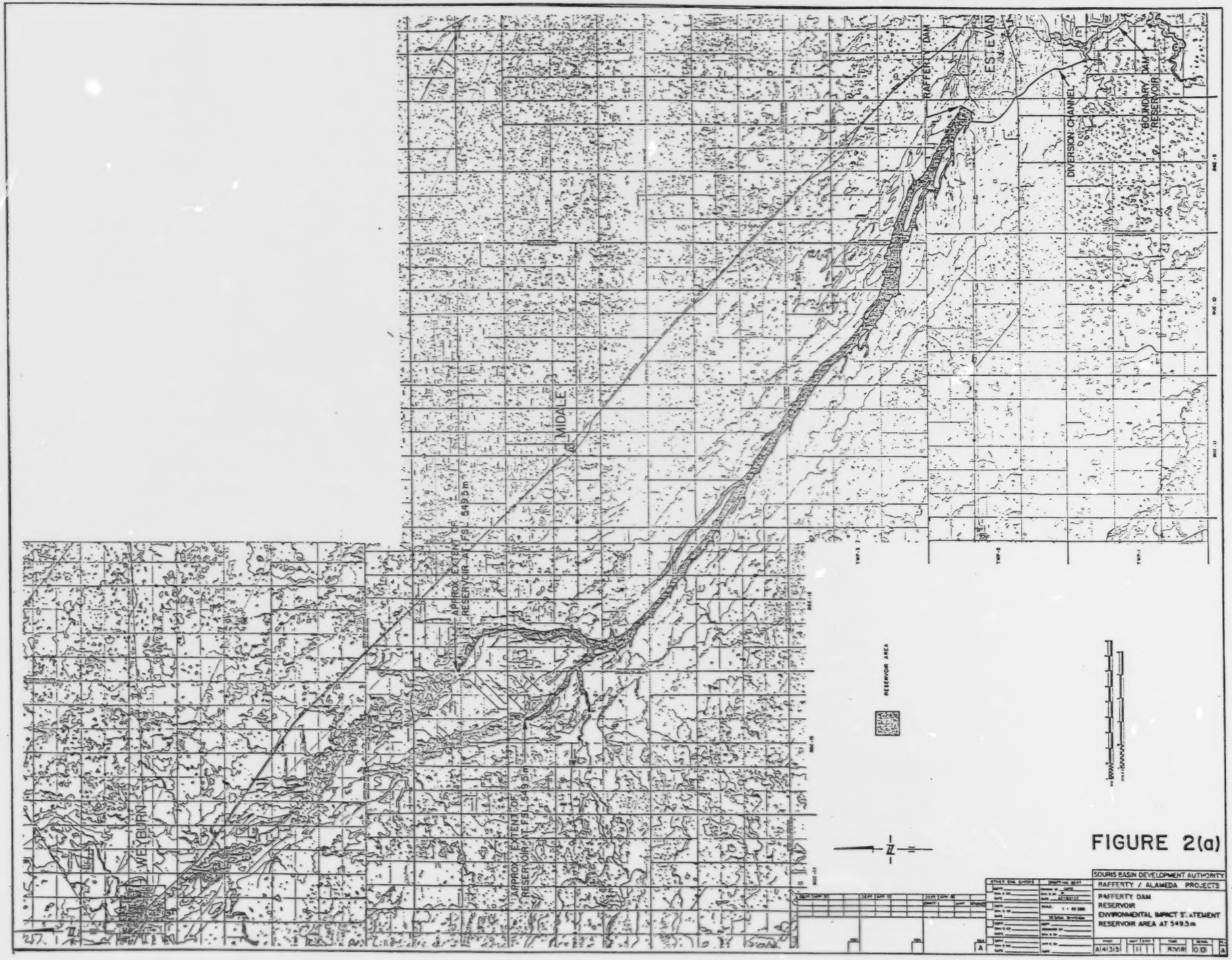
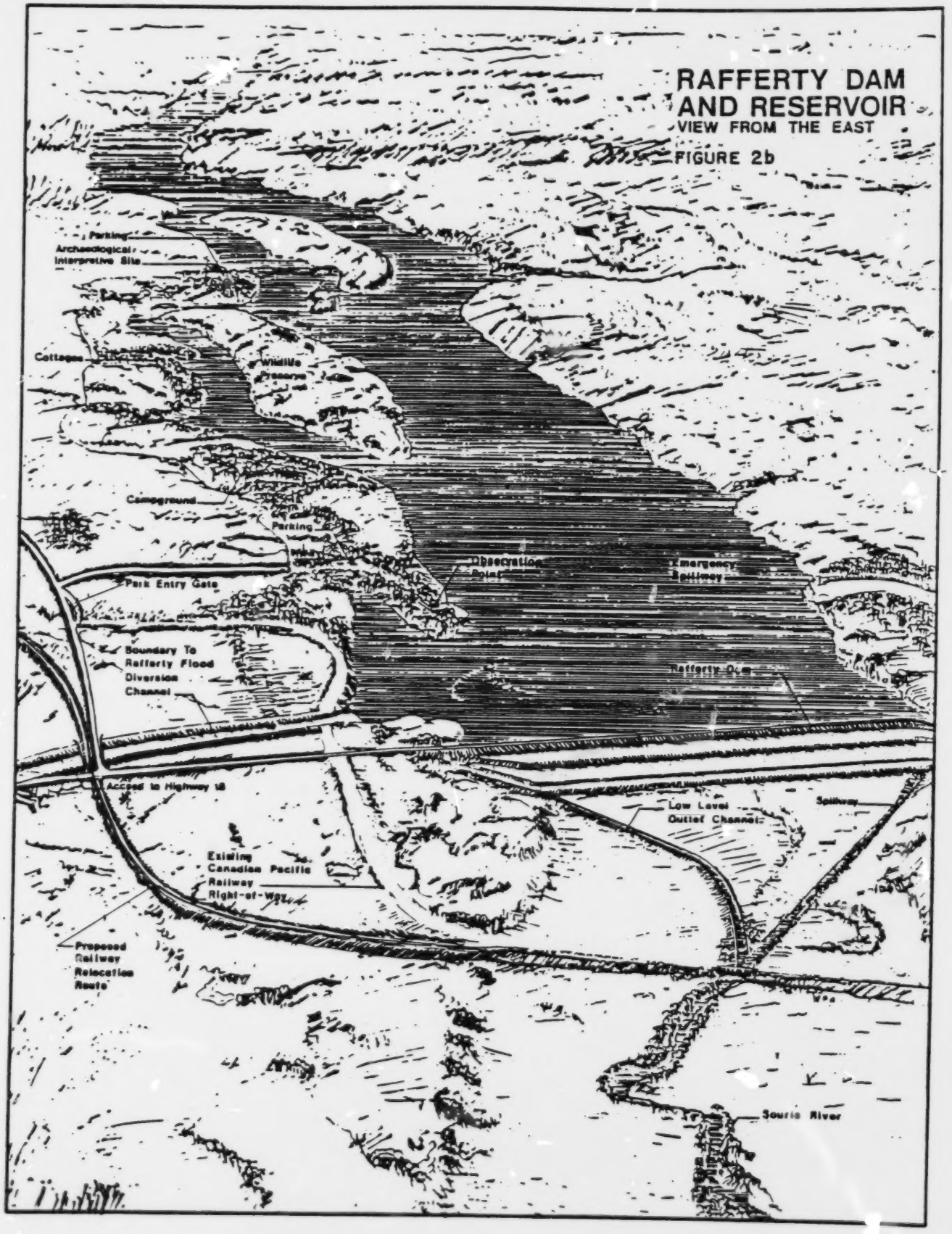


FIGURE 2(a)

SOURIS BASIN DEVELOPMENT AUTHORITY
RAFFERTY / ALAMEDA PROJECTS
RAFFERTY DAM
RESERVOIR
ENVIRONMENTAL IMPACT STATEMENT
RESERVOIR AREA AT 549.5m


RAFFERTY DAM
AND RESERVOIR
VIEW FROM THE EAST
FIGURE 2b
Parking
Archaeological/
Interpretive Site
Cottages
Wildlife
Preserve
Campground
Parking
Observation
Point
Emergency
Spillway
Park Entry Gate
Boundary To
Rafferty Flood
Diversion
Channel
Rafferty Dam
Access to Highway 18
Low Level
Outlet Channel
Spillway
Existing
Canadian Pacific
Railway
Right-of-Way
Proposed
Railway
Relocation
Route
Souris River

dam[3]. The profiles of the Reservoir at each of these elevations is depicted in Figure 3. Once completed, Rafferty Reservoir will be third largest impoundment of water in Saskatchewan after Lake Diefenbaker and Tobin Lakes.

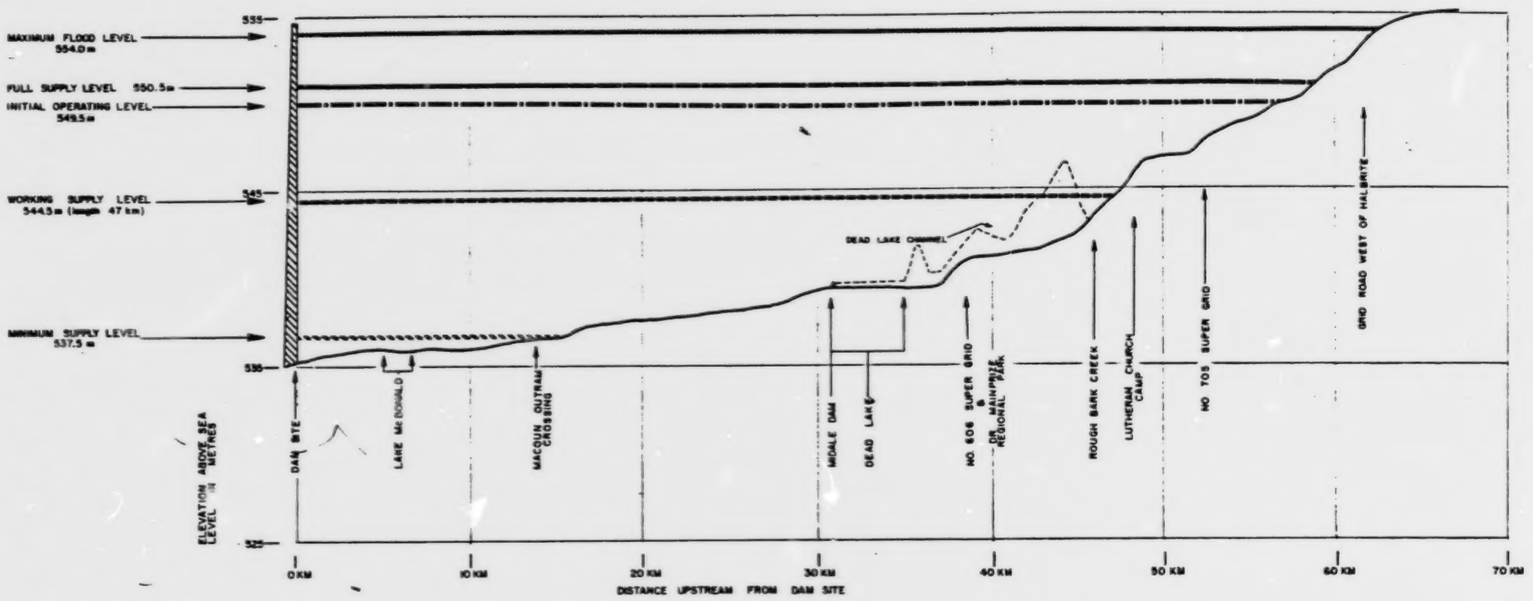
Both the Rafferty and Alameda Dams, which will have a useful life in engineering terms of a minimum of 50-100 years, are being designed by the consulting engineering firm of Cochrane-Lavalin. Lavalin Inc. has extensive experience in the design of such structures and is the largest consulting firm in Canada. A review of the available data together with an extensive drilling program have confirmed the technical feasibility of the Project. Structures will be designed with a minimum factor of safety of 1.3. The Souris Basin Development Authority has also retained the services of a review board comprised of three distinguished consultants to review and critique design and construction features of the project with special emphasis on safety factors. (The three external consultants on the review board bring a wealth of knowledge and experience to the Project. For example, the principle engineer from Saskatchewan who constructed the Gardiner Dam, an engineer from the U.S. Army Corps of Engineers who has worked on water projects around the world and an engineer who is currently working on a dam in Alberta being built on similar foundation conditions.)

B. Project Features

The facilities at Rafferty will consist of a zoned earth fill dam, a concrete service spillway, a low level outlet, an emergency spillway, and a reservoir. The features at Rafferty are illustrated in Figure 4 and a brief description of each of these features follows:

a) Earth Fill Dam

The impervious section of the dam will consist of compacted glacial till excavated from the emergency spillway (see Figure 5). Internal drainage system will consist of a granular chimney drain and granular horizontal drain. Due to the low-



RAFFERTY RESERVOIR	ELEVATION	TOTAL STORAGE	SURFACE AREA	LENGTH OF RESERVOIR
• MAXIMUM FLOOD LEVEL	554.0 m (1817.67 ft.)	630000 dams³ (511000 acre-ft.)	6200 ha (15320 acres)	61.5 km (38.4 mi.)
• FULL SUPPLY LEVEL (F.S.L.)	550.5 m (1806.19 ft.)	443000 dams³ (359000 acre-ft.)	4900 ha (12108 acres)	57.3 km (35.8 mi.)
• INITIAL OPERATING LEVEL (I.O.L.)	549.5 m (1802.82ft)	394000 dams³ (319000 acre-ft.)	4600 ha (11367 acres)	55.5 km (34.7 mi.)
• WORKING SUPPLY LEVEL	544.5 m (1786.41 ft.)	189000 dams³ (153000 acre-ft.)		47.0 km (29.4 mi)
• MINIMUM SUPPLY LEVEL (DEAD STORAGE)	537.5 m (1763.45 ft.)	13000 dams³ (10000 acre-ft.)		18.9 km (11.8 mi)

- MAXIMUM DEPTH OF RESERVOIR AT MAXIMUM FLOOD LEVEL = 17.5 metres (57.4 ft.)
- MAXIMUM DEPTH OF RESERVOIR AT F.S.L. = 15.0 metres (49.2 ft.)

FIGURE 3

SOURIS BASIN DEVELOPMENT AUTHORITY
RAFFERTY / ALAMEDA PROJECTS
RAFFERTY DAM
RESERVOIR
ENVIRONMENTAL IMPACT STATEMENT
RESERVOIR PROFILE

DRAWN BY GWH
DATE 87-04-03
PROJ A435 | UNIT / SYST 140 | FUNC RVR | REV A

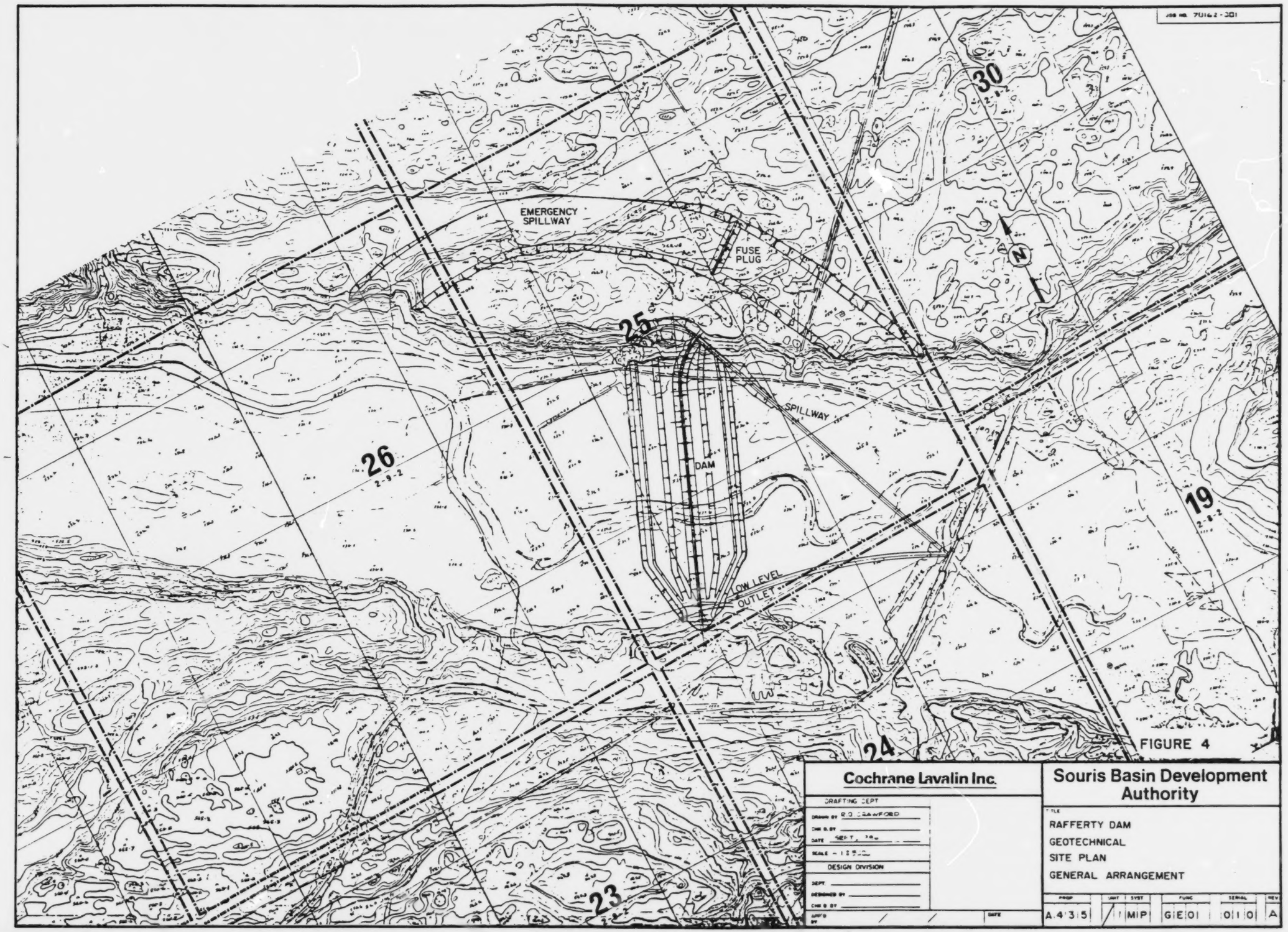


FIGURE 4

Cochrane Lavalin Inc.

DRAFTING DEPT
DRAWN BY R.D. CRAWFORD
CHK'D BY
DATE SEPT. 19..
SCALE - 1:5000
DESIGN DIVISION
DEPT
DESIGNED BY
CHK'D BY
APP'D BY DATE

Souris Basin Development Authority

TITLE
RAFFERTY DAM
GEOTECHNICAL
SITE PLAN
GENERAL ARRANGEMENT

PROJ	UNIT	SYST	FUNC	SERIAL	REV
A435		MIP	GE01	0110	A

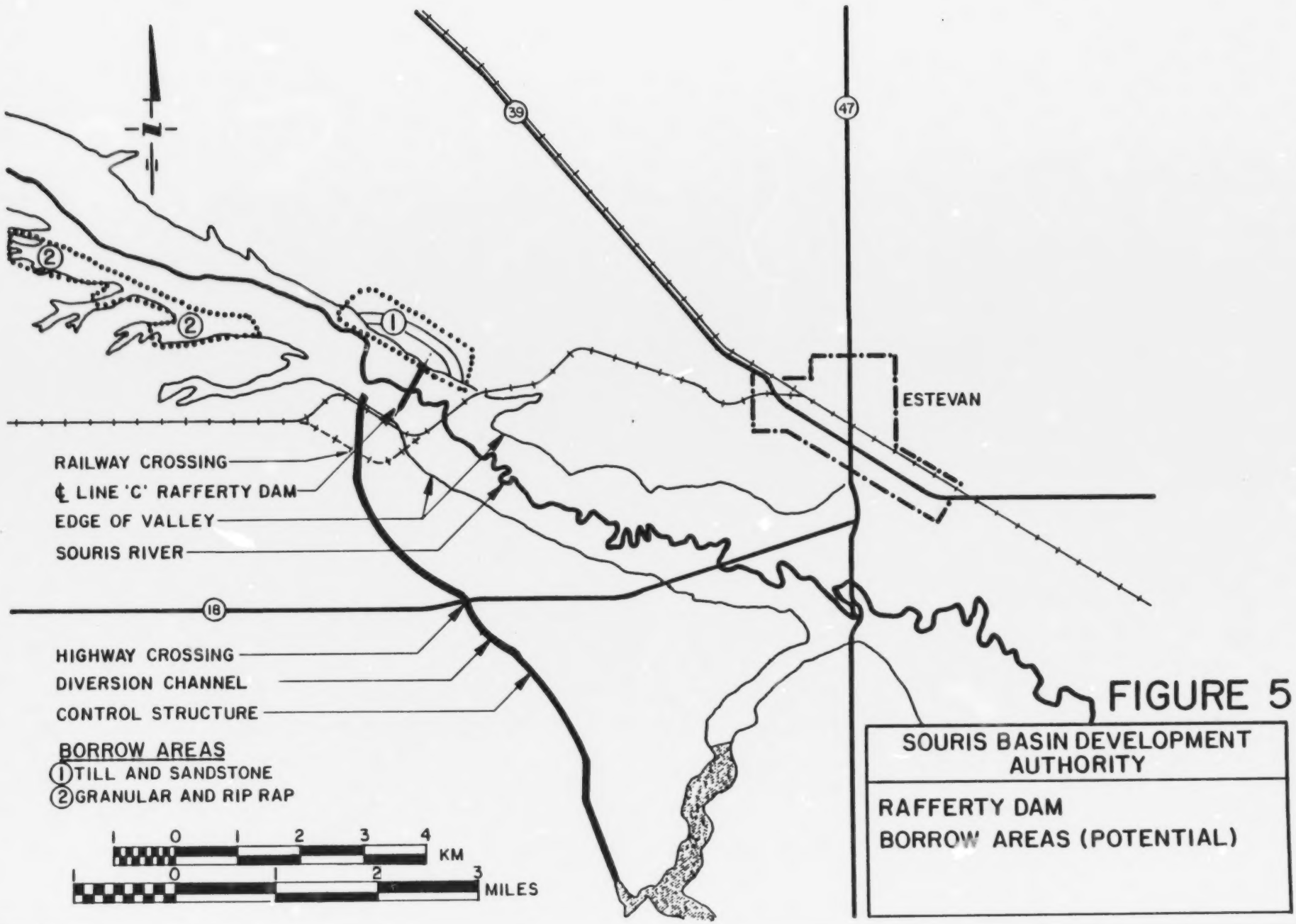


FIGURE 5

SOURIS BASIN DEVELOPMENT AUTHORITY

RAFFERTY DAM
BORROW AREAS (POTENTIAL)

strength clays in the foundation, long berms of limited height will be incorporated both upstream and downstream. A 163 m wide belt of wick drains will be incorporated under the dam fill to relieve foundation pore pressures during construction (see Figure 6). An upstream rock face will be incorporated to protect against wave action. The Dam will have an embankment length of 850 m and a crest elevation of 555 m. It will contain approximately 2,000,000 cubic metres of fill material.

b) Concrete Service Spillway

The proposed 150 m long reinforced concrete spillway will be sized to pass the 1 in 1,000 year flood of 220 m^3/s at reservoir elevation 554.0 m. It will consist of a gated control structure, chute and hydraulic jump stilling basin. The control structure will have three hydraulically operated 5.0 m high x 4.0 m wide vertical lift spillway gates and have provision for maintenance gates. The spillway gates are set on top of a 12 m long x 2.5 m high "ogee". The spillway chute will discharge into a stilling basin.

c) Low Level Outlet

The Low Level Outlet will permit release of water to be made for downstream uses such as irrigation. The proposed reinforced concrete low-level outlet was sized to pass 65 m^3/s at reservoir elevation 547.0 m. It will consist of an inlet, upstream conduit, gated control structure, downstream conduit and riparian pipe and hydraulic jump outlet.

d) Emergency Spillway

The proposed 1,750 m long zero slope emergency spillway is sized to pass 600 m^3/s at reservoir elevation 554.0 m. The spillway is controlled by a fuse dyke with a top elevation of 554 m.

The emergency spillway is located in the north abutment to take advantage of a natural sandstone channel which intersects the Souris River Valley approximately 900 m upstream of the dam. Approximately 1,000 m downstream of the emergency spillway

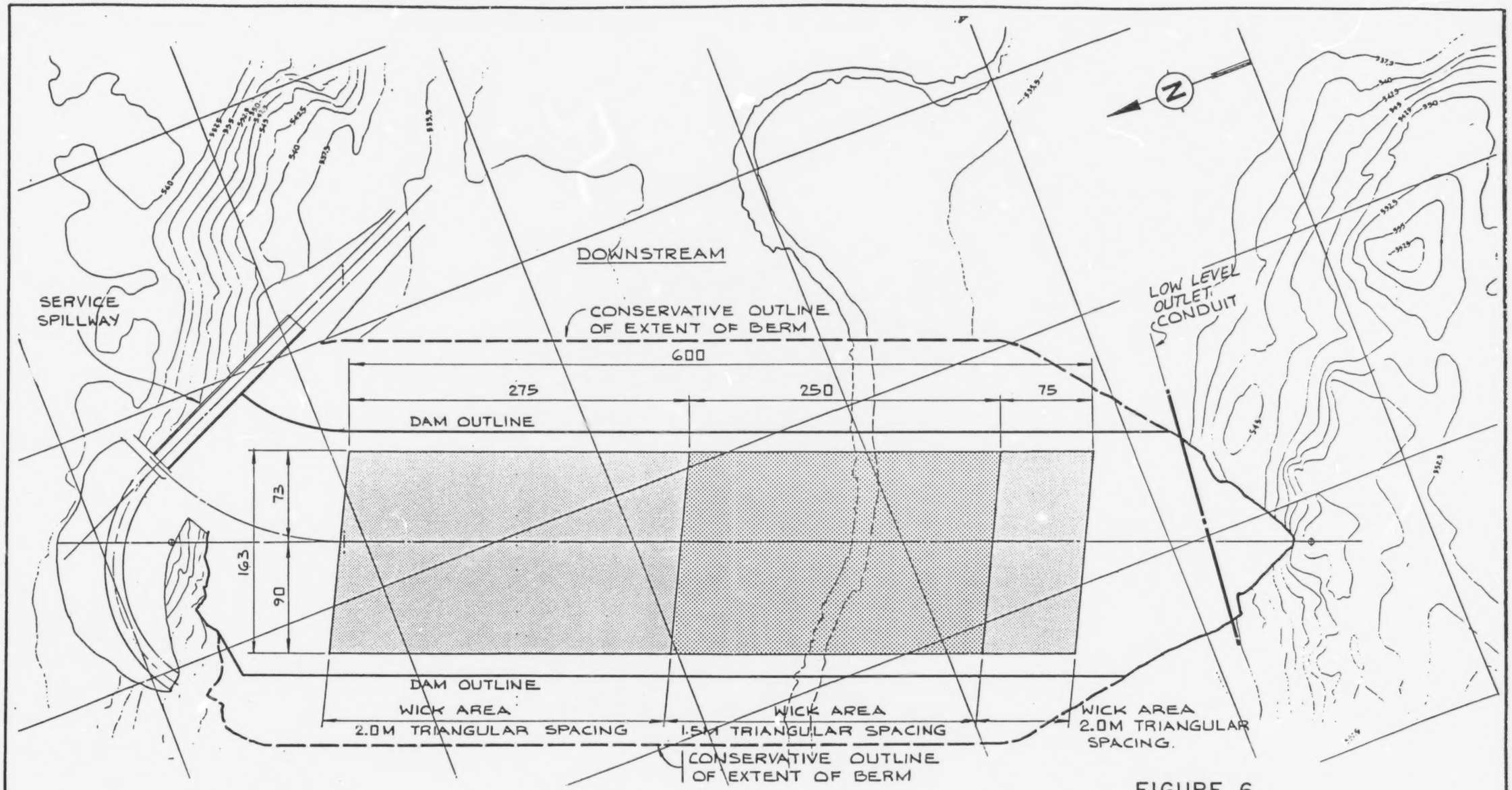


FIGURE 6

Cochrane Lavalin
CONSULTING ENGINEERS

Rafferty Dam

PLAN
WICK DRAIN LAYOUT

Date 87 APR. 06

entrance, the natural channel will be dammed and the emergency spillway will then cut across the glacical till cap between the natural channel and the valley. At no point is the emergency spillway nearer than 150 m to the service spillway.

e) Reservoir

The reservoir will be approximately 57 km long at Full Supply Level. It will have a maximum width of 1.2 km and a maximum depth of 15.1 m (49.5 feet) at Full Supply Level.

C. Project Timing

Construction of the Rafferty Dam is scheduled to commence 1988 April and to be completed 1990 October. Work will be of a seasonal nature with virtually all activities scheduled for the summer months.

D. Construction Activities

a) Topsoil

There are four areas where topsoil will be disturbed by the construction activities for the Rafferty Dam and Reservoir:

- under the main dam fill
- excavation for the emergency spillway
- causeway fill areas
- selected borrow areas for construction material such as gravel

The topsoil from under the dam fill will be stripped and stockpiled prior to placement of the fill. This stockpile will have approximately two seasons to dry and will be applied to the slopes of the dam and other excavation areas prior to seeding to grass for erosion protection.

It is not expected to recover the topsoil in the emergency spillway area as it is located on the uplands where surface rocks will not permit economical recovery.

As in the dam construction, the topsoil from causeway construction will be removed, stockpiled and then placed on slopes to be seeded to grass.

b) Dust-Proofing Roads

During construction:

All access roads during construction will be gravel surfaced roads. When dust is a problem on the access roads, they will be treated with dust retardant or wetted down with water to control dust.

After construction:

The main road connecting Highways 39 to 18 across the dam will be surfaced with an asphalt surface.

c) Fuel Storage on Site During Construction

Fuel storage on site during construction will be kept to a minimum. On site equipment will be fueled directly from fuel trucks hauling from Estevan.

If any fuel storage is required on site, the fuel would be stored in a conventional fuel storage tank with earth containment dikes around the tank. The volume within the containment dikes would be large enough to hold the contents of a full tank plus an adequate allowance for rainwater.

d) Flood Routing During Construction of the Dam

Dam construction is scheduled to begin in 1988 prior to the spring runoff of that year. Earth cofferdams will be constructed around the main dam fill area and the low level outlet pipe area. A gap in the cofferdams between these two areas will be left to permit passage of flood waters in years 1988 and 1989.

The cofferdam flood channel gap will be sized to handle a 1 in 20 year flood event. Immediately following the 1989 flood period, the cofferdam gap would be closed and the main dam fill would be brought up to full height. Any flood waters after closing the cofferdam will be routed through the completed low level outlet pipe.

During the critical period of spring 1988 and 1989, snow pack will be monitored. If a larger than 1 in 20 year flood is estimated, cofferdams will be raised in areas to protect the

uncompleted work (see also Operating Plan in Chapter 7 Hydrology).

e) Borrow Areas

The basic materials for dam construction will be obtained from the following areas:

Granular Materials: Granular materials will be obtained from a source located approximately 3 km upstream of the dam. Sec. 27, Tp. 2, Rge. 9, W 2nd.

Dam Fill: The main fill for the dam, including tills and miscellaneous fills, will be obtained primarily from the emergency flood channel located on the north bank at the dam axis.

Riprap: Natural rock will be used for riprap to protect slopes against erosion. This riprap will be harvested from the surface uplands mainly in the Emergency Flood Channel area and the granular source area. If these sources do not provide sufficient riprap, additional rock will be obtained from surface harvesting in close proximity to the dam.

E. Employment Requirements

The Rafferty Project is expected to create approximately 125 person years of employment during the construction phase. A distribution of the labour requirements is as follows:

Total Employment Generated	125 Person Years
By S.B.D.A. & Principal Contractor	90 Person Years
By Others	35 Person Years

Description	Approximate Labour Requirements (Person Years)
Trades (Operators, Carpenters, Labourers, etc)	75
Technical (Engineering, Surveying, etc.)	25
Others	25
Total	125 Person Years

NOTE: Employment during operation of the Dams to be the responsibility of Saskatchewan Water Corporation

F. Employment and Business Policies

Wherever possible, contracts will be awarded by the S.B.D.A. through the competitive bidding process to qualified contractors. Successful bidders/contractors will be responsible for hiring their own work force.

Goods and services for the project will be purchased from within the Province and within the Project Area to the maximum extent feasible. Project contractors will be required to comply with corporate policies on:

- preference for Saskatchewan products and services;
- use of Local Labour; and
- use of Saskatchewan suppliers and sub-contractors.

II. DOWNSTREAM CHANNELIZATION

A. General Description

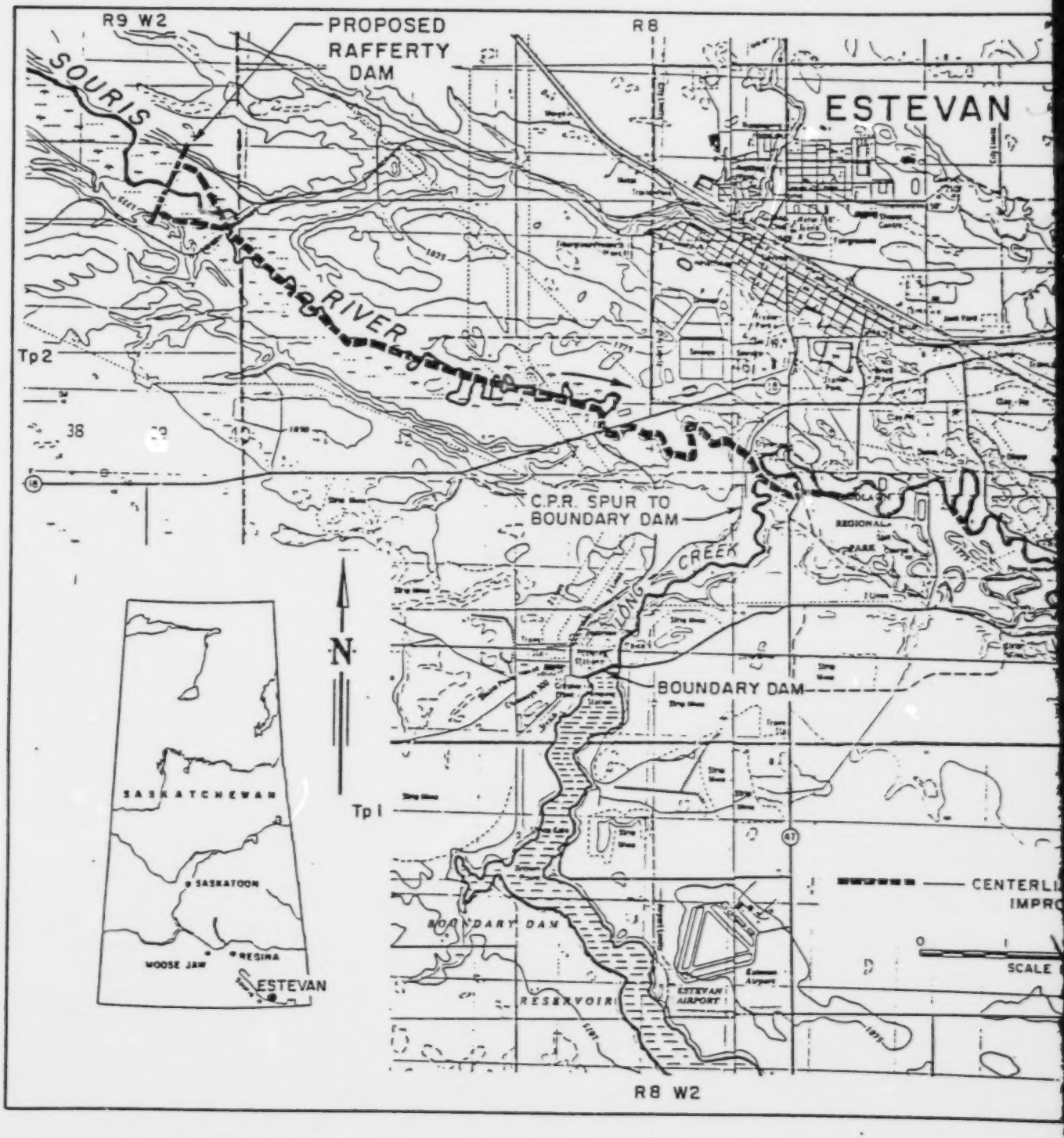
Some channelization downstream of the Rafferty Dam will be required in order to accommodate expected flow releases for such downstream uses as irrigation, recreation and for flood control. At present, this area is extremely prone to flooding both from the flows downstream on the mainstem of the Souris and flows from Long Creek. The areas where channelization is required are limited to the reach from the proposed Rafferty Dam site downstream to a location on the

Souris River close to the proposed location of the Shand Power Station. The mainstem of the Souris River will not be used to convey water from the Rafferty Reservoir to the Shand Power Station. Rather, Saskatchewan Power Corporation will construct a pipeline to transport the water to Shand. This reach of the Souris River can be divided into two distinct sections; the upstream section extending from the proposed Rafferty Dam site downstream to the CPR spur line running south to Boundary Dam Power Station and the downstream section extending from the CPR spur line to the Shand Power Station location (see Figure 7).

The upstream section is characterized by an underdeveloped channel with very limited capacity, while the downstream reach is characterized by a well-developed channel section with a bankfull capacity approaching a capacity of 85 m^3/s. The backwater effects created by the Long Creek alluvial fan on the floor of the Souris Valley and by major flooding on Long Creek have a tendency to suppress Souris River channel development upstream of the confluence, while the increase in discharge downstream of the confluence tends to promote the well-developed channel observed in this section.

B. Project Features

The Souris Basin Development Authority commissioned a pre-feasibility channel improvement study by the Prairie Farm Rehabilitation Administration which identified those areas requiring channelization. The actual sizing of the channelization work required and the precise locations will be determined in the detailed design phase. Because of the need for a more detailed analysis in this regard, it is not possible with any confidence to place a cost estimate on the work required. Although an estimate of $3 million has been provided by PFRA for this work, given the preliminary level of the analysis, little confidence can be placed on this figure. Accordingly it has not been included as a project cost until such time as a reasonably reliable figure is available. Channel improvements in the upstream section will consist of continuous


R9 W2
PROPOSED
RAFFERTY
DAM
R8
SOURIS
RIVER
ESTEVAN
Tp2
38
C.P.R. SPUR TO
BOUNDARY DAM
LONG
CREEK
BOUNDARY DAM
N
SASKATCHEWAN
SASKATOON
REGINA
MOOSE JAW
ESTEVAN
Tp1
BOUNDARY DAM
RESERVOIR
ESTEVAN
AIRPORT
CENTERLI
IMPRO
SCALE
R8 W2

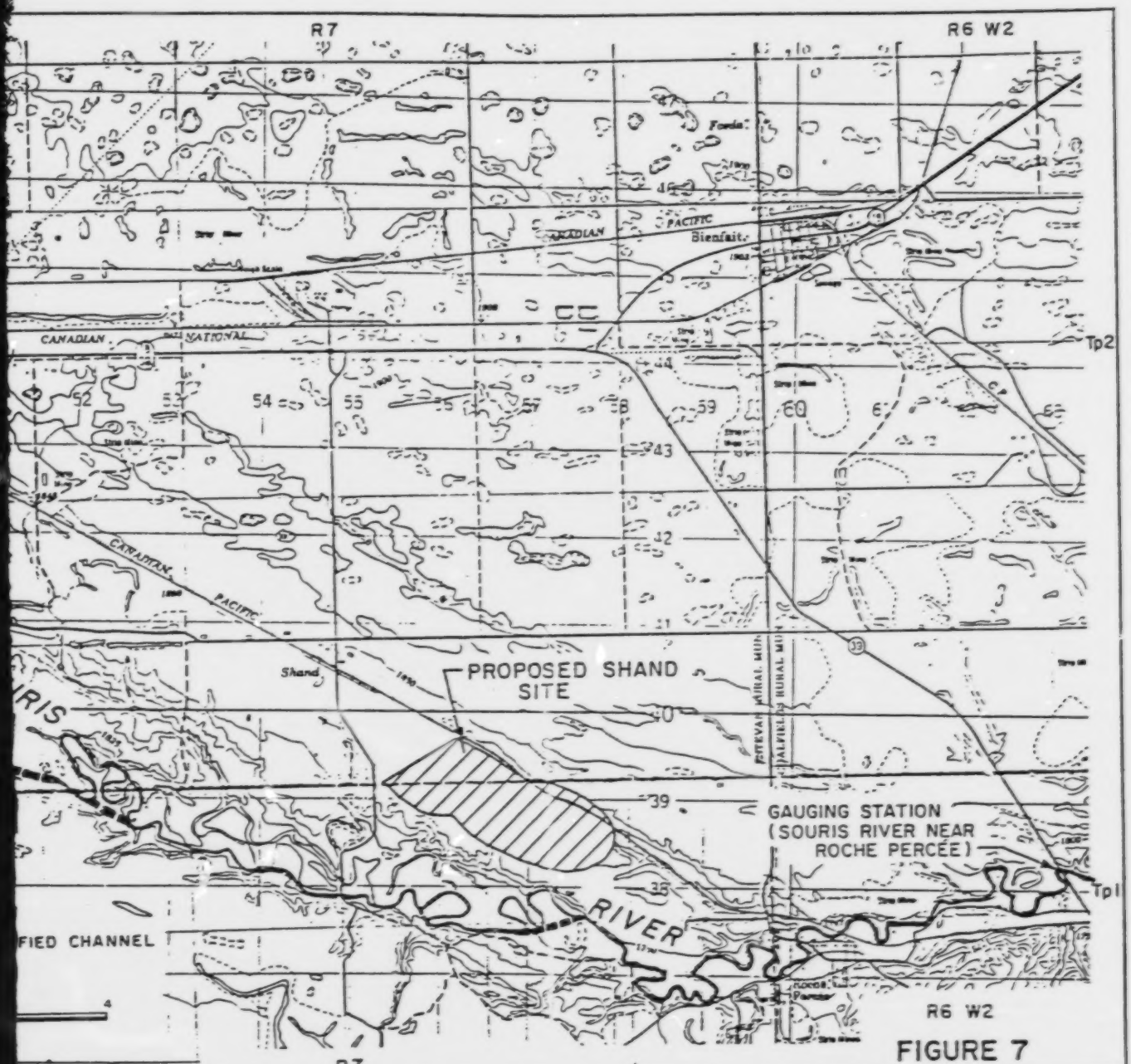


FIGURE 7

DESIGNED mld	SUBMITTED M. Lawrence	Agriculture Canada	SOURIS BASIN DEVELOPMENT AUTHORITY
DRAWN H.Y. Mah	DATE 87-04-23	Prairie Farm Rehabilitation Administration / Administration du rétablissement agricole des Prairies	SOURIS RIVER CHANNEL IMPROVEMENT STUDY
CHECKED mld	APPROVED R.C. Lambert DIRECTOR, E&S SERVICE	ENGINEERING SERVICE	VICINITY MAP AND PLAN OF STUDY REACH
	DATE 87-04-28		SCALE AS SHOWN / DATE MARCH/87 / 113136

channel excavation upstream of Highway 18 and bottom dredging downstream of Highway 18. Initial sizing of the channel will be for 14 m^3/s flows in the upper section and 85 m^3/s in the lower section.

The design value of the 14 m^3/s represents the future requirements for irrigation and other downstream uses. It would also be necessary to make controlled releases of this magnitude to return the Rafferty Reservoir to normal operating levels following significant floods. The design value of 85 m^3/s represents the controlled release following a major flood inflow at the proposed reservoir. These channel capacities should be considered as preliminary and are subject to further refinement.

The upstream reach extending from the proposed location of Rafferty Dam to the CPR Boundary Dam Power Station line will require continuous channel excavation upstream of Highway 18 in order to contain a flow of 14 m^3/s within the channel banks. The downstream reach from the CPR Boundary Dam Power Station line to the proposed location of the Shand Power Station would require several local improvements consisting of meander loop cutoffs and channel dredging in order to contain a flow of 85 cms within the channel banks. Insofar as the lower reach work was required, it will not be possible to avoid agricultural areas with the location of the channel improvements; developed areas such as building sites can be avoided however, the identified alignment of the cutoffs should be considered as preliminary. Considerable flexibility existed in the selection of the final cutoff alignments that result in essentially the same hydraulic performance. The final alignment will be based upon a detailed balancing of land use, ownership and access considerations.

In addition to these improvements in the lower reaches, it will be necessary to lower the CPR weir crest, relocate Highway 47 and to dredge the bottom upstream of Highway 47. The CPR weir which is presently used to pond water for the irrigation needs of the golf course in Woodlawn Regional Park will be removed and replaced with a steel sheet pile and rock-armoured overflow weir.

The relocation of Highway 47 has been thoroughly addressed by Saskatchewan Highways and Transportation. Their relocation proposal which included a cutoff channel, were integrated into the channelization plans for the River. The Saskatchewan Highways and Transportation Proposal was not altered in any way by the channel improvement work required to date. The bottom dredging upstream of Highway 47 is required as a continuation of the channelization required for the upstream reach. This bottom dredging affects the City of Estevan raw water supply and the Old Highway 18 bridge. The pipeline crossing will have to be lowered and the bridge replaced.

Material excavated will be deposited in areas so as to minimize environmental disruption. It will be desirable to identify different placements of material in the areas to serve special purposes such as agriculture and/or wildlife habitat enhancement. Such details will be addressed in the final design stages.

C. Project Timing

Detailed design work will be completed by June, 1988. Construction of the improved channel is scheduled to commence spring of 1989 and to be completed later in the same year. Work will be of a seasonal nature with virtually all activities scheduled for the summer months.

D. Construction Activities

a) Excavation

Some portions of the work are suitable for scraper excavation, while dragline excavation will be required in wet areas. When deposited into environmentally acceptable locations, spoil material will be shaped aesthetically. Required granular material will be obtained from borrow pits identified above for the Rafferty Dam site.

b) CPR Weir

The CPR weir will be replaced by a new sheet steel pile and rockfill weir structure.

c) City of Estevan Water Treatment Plant

The Estevan water supply pipe from Boundary Dam to The Estevan Water Treatment Plant will be replaced by a new pipe and concrete pipe encasement in the channelization area.

d) Rural Crossings

The upstream reach will require the construction of three bridges, each has a 12 m span concrete deck with a treated timber substructure. The need for these crossings in Sections 19, 18 and 17-2-8-W2 was identified by the Saskatchewan Department of Agriculture in their 1976 preliminary study. Low level ford crossings will not be viable for the intended reservoir release scenarios.

A detailed knowledge of land use and ownership is necessary. Discussions with concerned parties will be undertaken before the detailed requirements for access can be determined.

e) Municipal Bridge

A new municipal crossing in Section 24-2-9-W2 of the upstream reach might be necessary due to relocation of the channel. If required, a 12 m span concrete deck on a treated timber substructure would be proposed for the upstream reach. For the downstream reach, a 36 m span concrete deck with treated timber substructure is proposed for this replacement. A detailed investigation and design, particularly in the case of the old Highway 18 bridge, where alternate means of access to the water treatment plant may be found more favourable, will be undertaken in the final design phase.

f) Relocated Sask Tel Underground Cables

It will be necessary to relocate three buried cables in the upstream reach.

g) Upgrade Department of Highways Bridge

It will be necessary to upgrade Highway 18 Bridge to include the addition of one 12 m span, additional support piles, and an allowance for a temporary traffic detour around the bridge.

h) Relocated SPC Underground Gas (Poly.) Lines

It will be necessary to lower two polyethylene buried gas lines.

i) Relocate SPC Underground Gas (Steel) Line

It will be necessary to relocate the buried high-pressure steel pipeline which crosses the Souris River and supplies gas requirements to the Boundary Dam Power Station. As continuous gas supply must be maintained to the Power Station, it will be necessary to install temporary facilities to reroute gas supply, supply and installation of a new high-pressure line, local care of water, and removal of temporary rerouting facilities.

E. Employment Requirements

Total Employment Generated	17 person years
By Contractor	14.5 person years
By Others	2.5 person years

III. THE RAFFERTY-BOUNDARY DIVERSION CHANNEL

A. General Description

The Authority is proposing to construct a diversion channel connecting the existing Boundary Reservoir with Rafferty (see Figure 8). The channel has a number of benefits. First, the channel would provide the opportunity to reduce flood peaks at Estevan, Roche Percee and Oxbow which currently occur as a result of uncontrolled flows from Long Creek. Second, the channel will result in a faster filling of the Rafferty Reservoir with available surplus flows from Long Creek. Third, the channel will provide the opportunity to store water from the Long Creek drainage area which otherwise would be

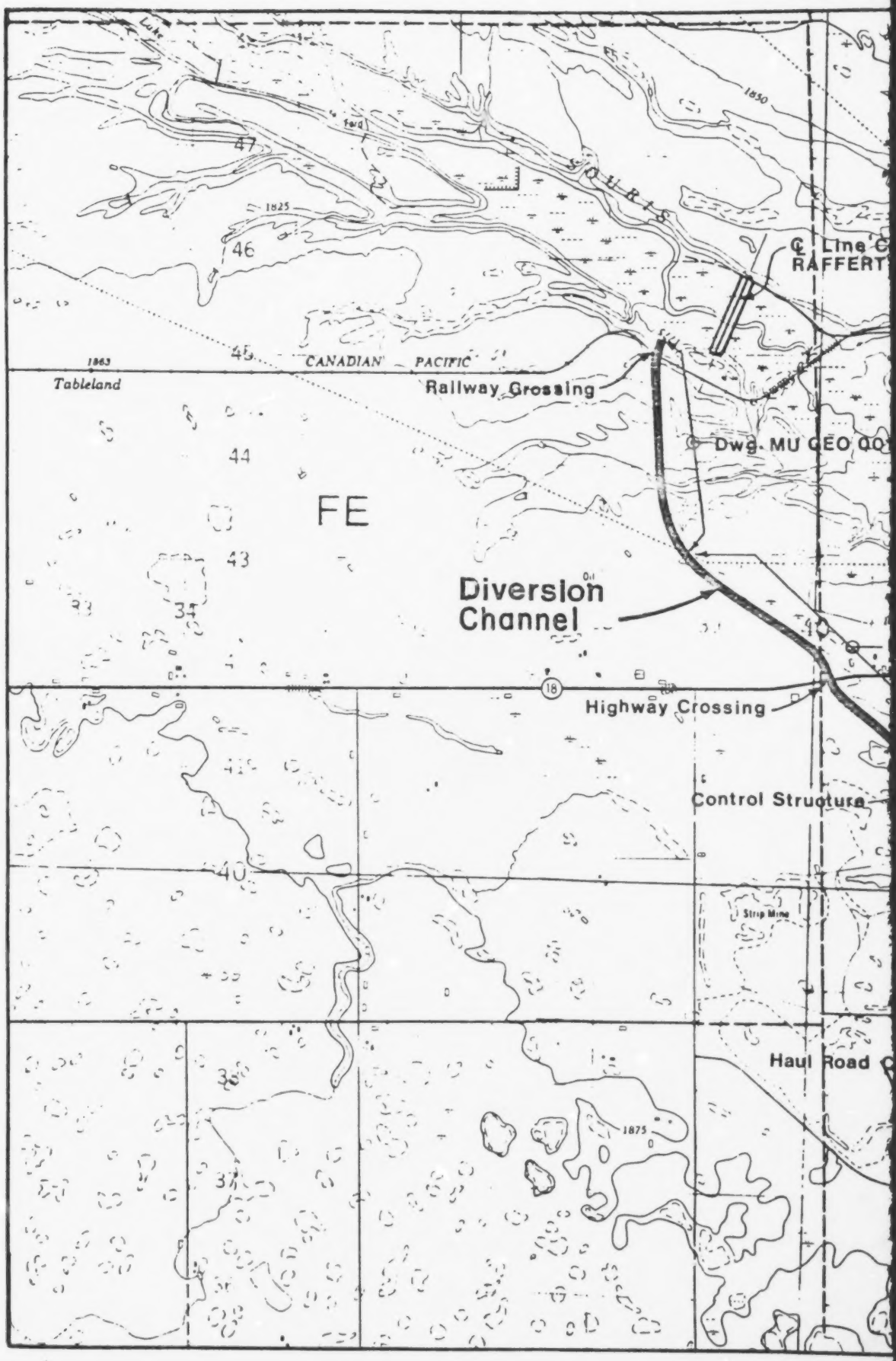

1850
1825
47
46
45
44
43
42
41
40
39
38
37
1875
SOURIS
1963
Tableland
CANADIAN PACIFIC
Railway Crossing
FE
Diversion
Channel
18
Highway Crossing
Control Structure
Strip Mine
Haul Road

FIGURE 8

Cochrane Lavalin Inc.

DATE	CONTRACT NO	PARTICULARS	TENDER / A.F.C.	APP'D

DISTRIBUTION HISTORY

Souris Basin Development Authority

TITLE

RAFFERTY DAM
DIVERSION CHANNEL
GENERAL ARRANGEMENT
SITE PLAN

PROP				UNIT		SYST		FUNC			SERIAL			REV.
A	4	3	5			M	U	G	A	-	0	0	1	

spilled and lost to further use in Saskatchewan. Fourth, the channel will allow the Rafferty Reservoir to be operated at a lower level until oil reserves in its upper reaches are depleted. Fifth, the material excavated for the channel will provide fill for a section of the road which will connect Highway 18 to Highway 39 across the dam. Sixth, the channel will also enable an additional source of water supply to Boundary Reservoir from Rafferty if Boundary Reservoir reaches critically low levels. (Pumping would be required part of the way to the control structure.)

B. Project Features

The diversion channel will consist of an earth channel, a concrete inlet and outlet and a gated concrete control structure. Figure 9 illustrates the profile of the channel. A brief description of each of these features follows:

a) Channel

The channel will be excavated during the construction from natural terrain and would be 9.5 km in length with varying dimensions depending on the material in which it is excavated. The bottom width will vary from approximately 4 m to 8 m with side slopes varying from 2H:1V to 4H:1V. The channel will be sloped such that water would flow naturally from Boundary Reservoir to Rafferty Reservoir. Pumping will be required to transfer water from Rafferty to Boundary when water elevations in Boundary Reservoir require augmentation to support the Boundary Dam Power Station.

b) Inlet/Outlet Structures

The inlet structure will be a low height concrete or rock filled weir with a crest 0.5 m above the channel invert. The weir will maintain a reasonable depth of water in the channel so as to prevent erosion of the channel bottom when return flows are transferred to Boundary Reservoir.

The outlet will be a concrete weir and small stilling basin to provide an erosion proof exit for the water.

STN. 0+400 - WEIR
(CREST EL. 557.8)
STN. 1+000 - COAL HAUL ROAD
STN. 1+920 - COAL HAUL ROAD
STN. 4+000 - INV. = 557.09
BOUNDARY
MAX. FLOOD LEVEL EL. 563
F.S.L. 560.8
M.S.L. 555.5
S = 0.0071%

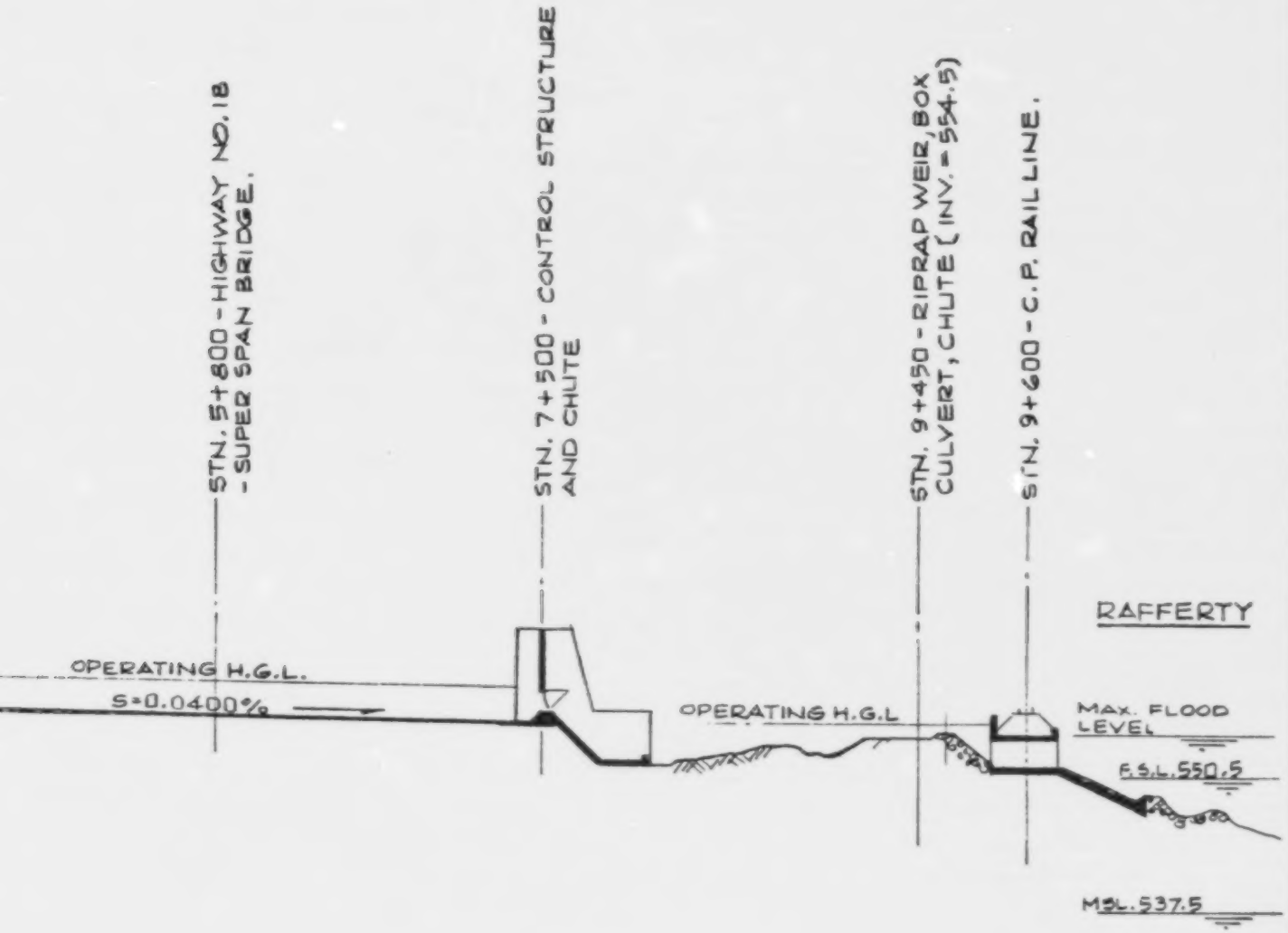


FIGURE 9

Cochrane Lavalin
CONSULTING ENGINEERS

RAFFERTY DAM - LINE 'C'
DIVERSION CHANNEL PROFILE

Date DEC. 1986

c) Control Structure

A concrete control structure will be located at the best suited place along the channel centre-line. The control structure will be gated to control water flows in either direction and maintain channel water elevations at Boundary Dam Reservoir levels.

d) Pump Station

A pump station will be located at the Rafferty Reservoir to pump water from Rafferty to Boundary when the Boundary Reservoir is low. A pump flow of approximately 1.0 m^3/sec. will be required.

e) Employment Requirements

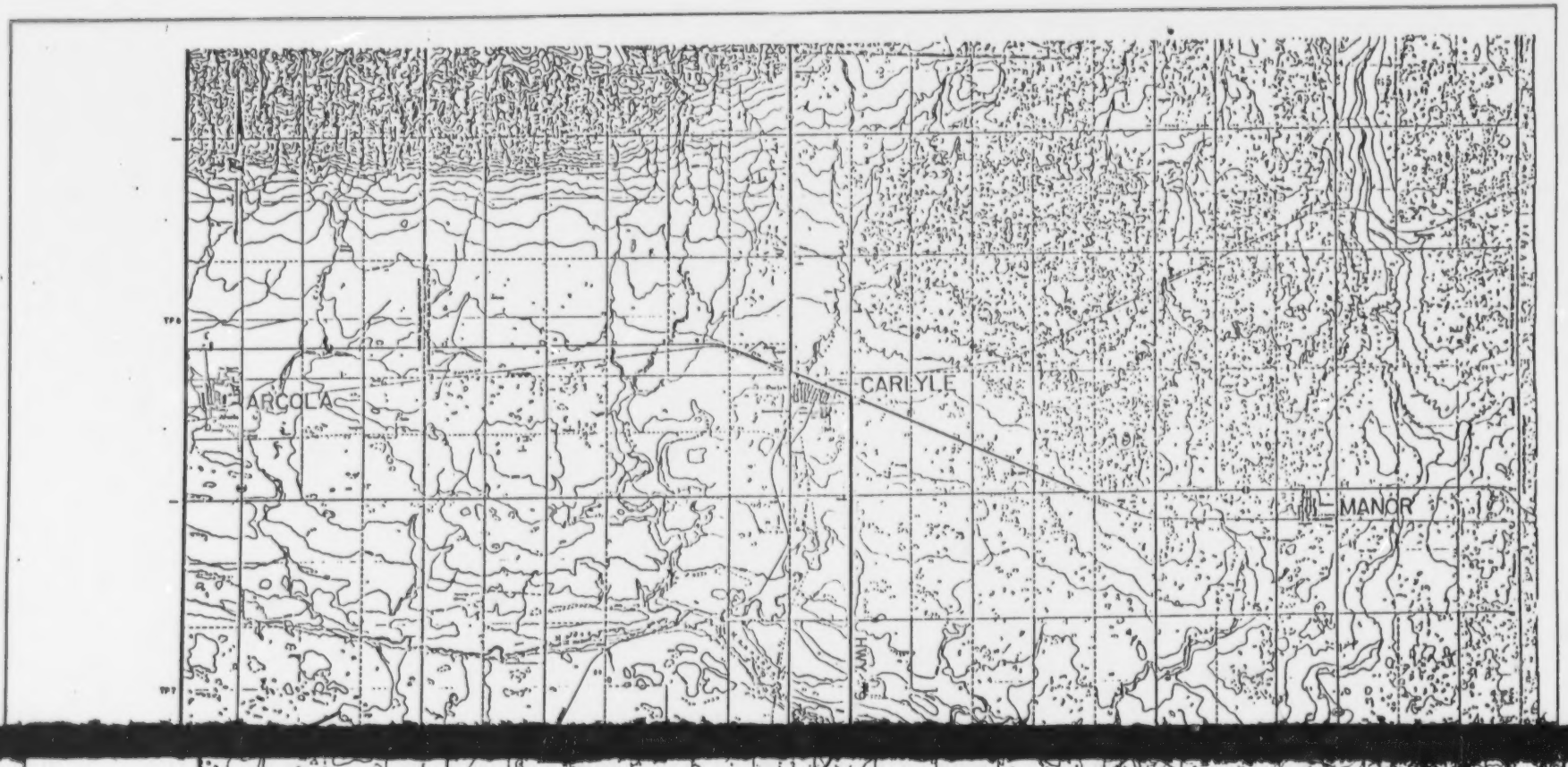
The Diversion Channel is expected to create approximately 36 person years of employment during the construction phase.

Trades (operators, carpenters, labourers, etc.)	20 person years
Technical (engineering, surveying, etc.)	12 person years
Others	4 person years
TOTAL	36 person years

IV. ALAMEDA DAM AND RESERVOIR

A. General Description

The Alameda Dam will be constructed on the Moose Mountain Creek approximately 14 km north of the Town of Oxbow (See Figure 10). The Alameda Reservoir will, as with its counterpart at Rafferty, serve a number of purposes. The Alameda Reservoir (see artist's depiction in Figure 11) will provide recreation benefits for southeastern Saskatchewan and in particular will alleviate pressure that has been experienced in recent years at Moose Mountain Provincial Park from heavy visitation. A public park will be developed at Alameda and opportunities for cottage lots will be provided. As well, the Alameda Reservoir will serve to satisfy the majority of the


ARCOLA
CARLYLE
MANOR

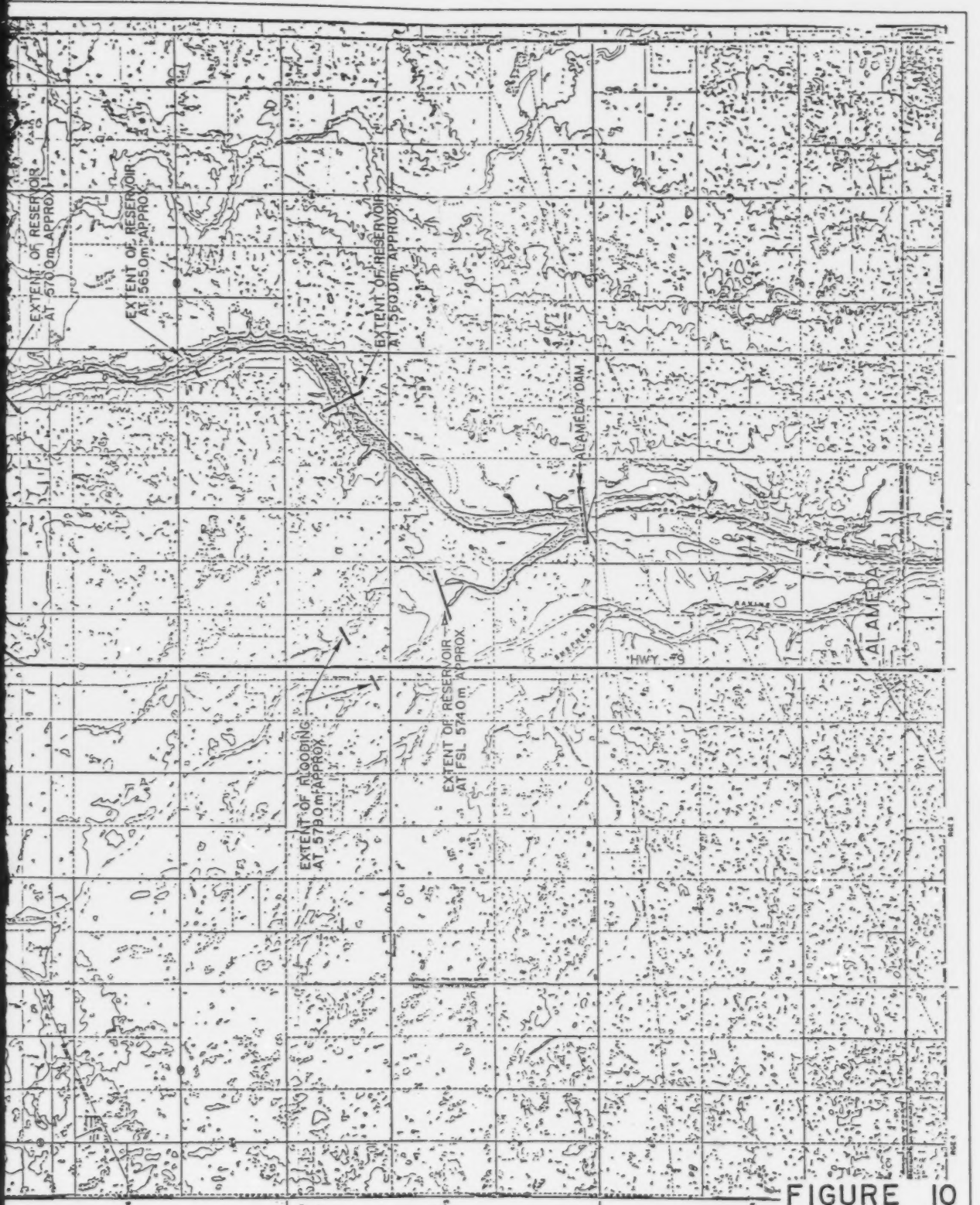

EXTENT OF RESERVOIR AT 570 m APPROX
EXTENT OF RESERVOIR AT 565 m APPROX
EXTENT OF RESERVOIR AT 560 m APPROX
ALAMEDA DAM
HWY - 9
ALAMEDA
EXTENT OF FLOODING AT 578 m APPROX
EXTENT OF RESERVOIR AT FSL 574 m APPROX

FIGURE 10

SOURIS BASIN DEVELOPMENT AUTHORITY

RAFFERTY / ALAMEDA PROJECTS

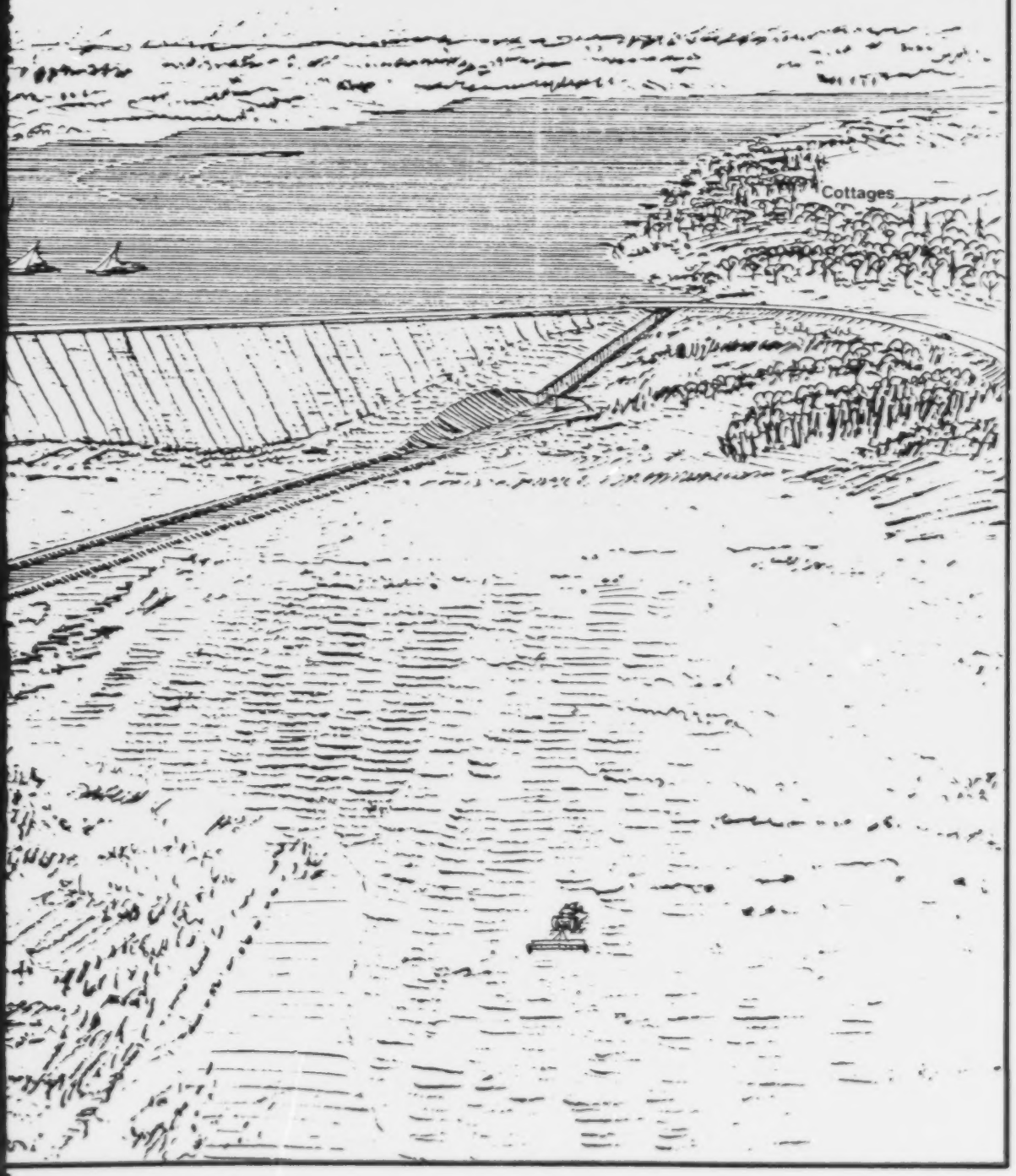
ALAMEDA DAM
RESERVOIR
ENVIRONMENTAL IMPACT STATEMENT
EXTENT OF FLOODING AT
VARIOUS RESERVOIR ELEVATIONS

AM 316 | 1 | 4101 | RAVR | 0001 | A

ALAMEDA DAM

VIEW FROM THE SOUTH

FIGURE II



Saskatchewan apportionment obligations to the United States. (Apportionment is the amount of water Saskatchewan must pass, under Treaty, to the United States. The terms of this apportionment are defined by the Boundary Waters Treaty of 1909 between Canada and the United States. The largest single allocation for water on the Souris River in Saskatchewan is required for apportionment with the United States.)

The Alameda Reservoir will also be used as a supply of irrigation water. Current plans are for a maximum of 1,619 ha of upland soils to be irrigated from the Alameda Reservoir and an additional 1,214 ha of valley lowlands, primarily in the Souris River Valley below its confluence with Moose Mountain Creek.

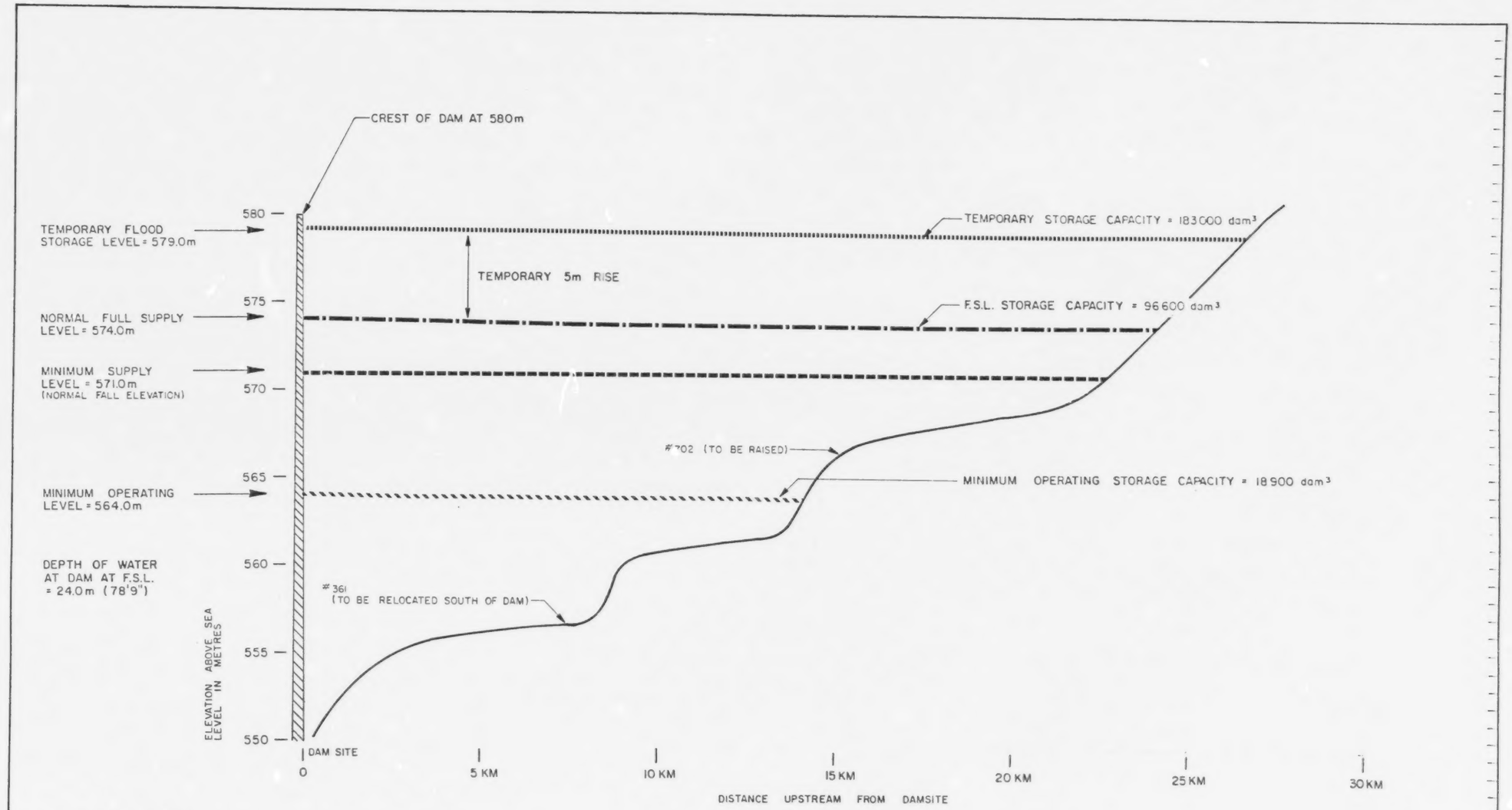
The Alameda Reservoir will operate with a Full Supply Level (FSL) of 574 m and a Maximum Flood Level (MFL) of 579 m. At FSL, the Alameda Reservoir will have a surface area of 1,350 ha and a volume of 95,000 dam^3. At Maximum Flood Level, the Alameda Reservoir will have a surface area of 2,250 ha and a volume of 185,000 dam^3 (see Figure 12). The Alameda Reservoir will have a gross catchment area of 5,203 sq. km.

B. Project Features

The project consists of a zoned earth fill dam, a concrete service spillway, a low level outlet and a reservoir (see Figures 13 and 14). A brief description of each of these follows:

a) Earth Fill Dam

The Alameda Dam will have an enbankment length of 1,200 m and a crest elevation of 580 m and will contain approximately 1,500,000 cu metres of fill material. The dam consists of a central impervious core and either uniformly sloped or bermed upstream and downstream faces. The upstream outer shell contains a layer of riprap to counteract the effects of wave action. Highway 361 will be relocated across the crest of the Dam.



LENGTH OF RESERVOIR
AT F.S.L. = 24.5 KM
AREA = 1340 ha

LENGTH OF RESERVOIR AT
FLOOD STORAGE LEVEL = 27 KM
AREA = 2210 ha

FIGURE 12

DEPT	APP'D	REV

OTHER ENG CHECKS: DEPT / CHK'D BY / DATE

DRAFTING DEPT: DRAWN BY GMM; CHK'D BY #; DATE 87-04-04

SCALE

DESIGN DIVISION: DEPT / DESIGNED BY / CHK'D BY / APP'D BY / DATE

SOURIS BASIN DEVELOPMENT AUTHORITY

RAFFERTY / ALAMEDA PROJECTS

ALAMEDA DAM
RESERVOIR
ENVIRONMENTAL IMPACT STATEMENT
RESERVOIR PROFILE

PROP	UNIT	SYST	FUNC	SERIAL	DL
A43	10		RVR	00	

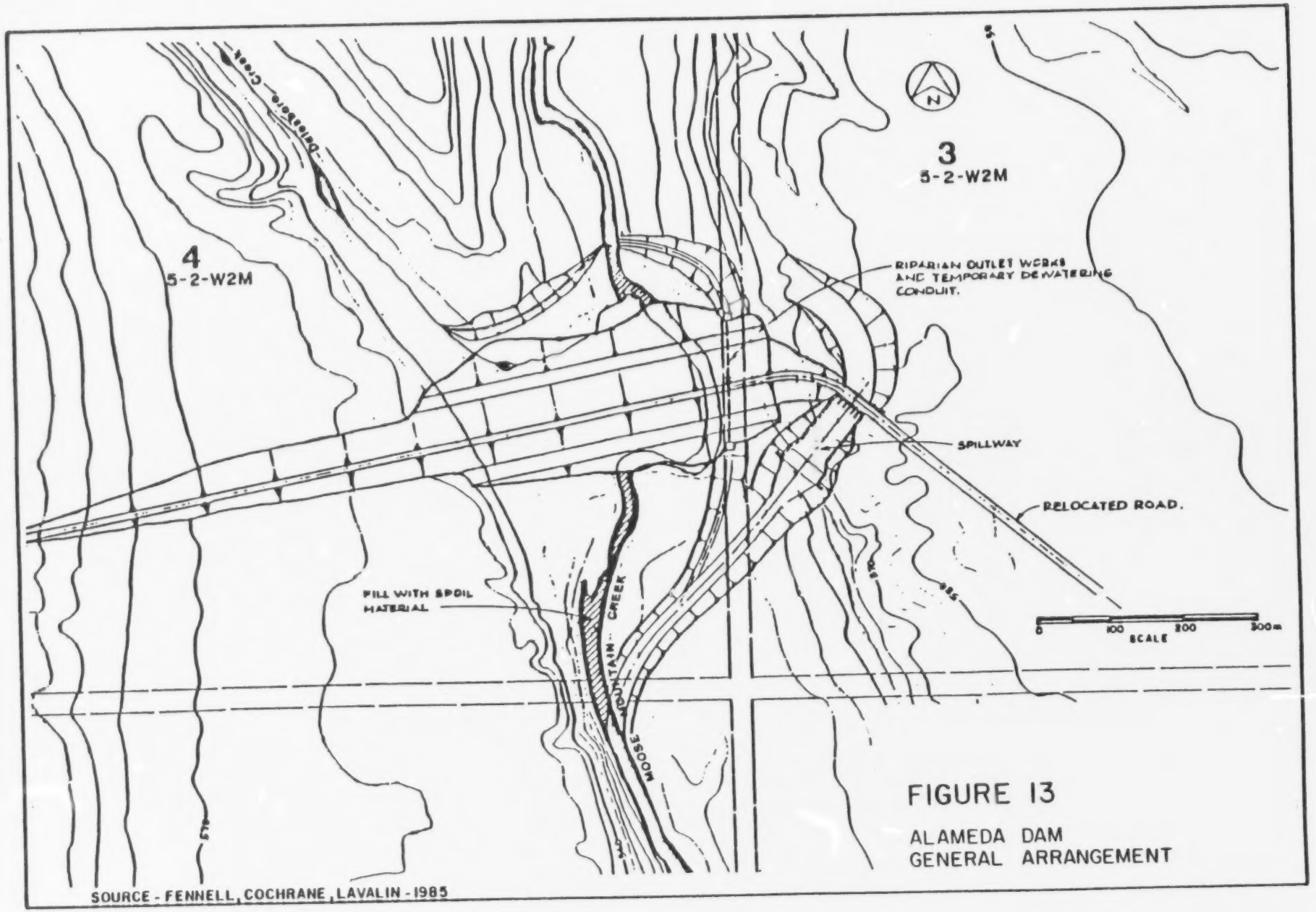
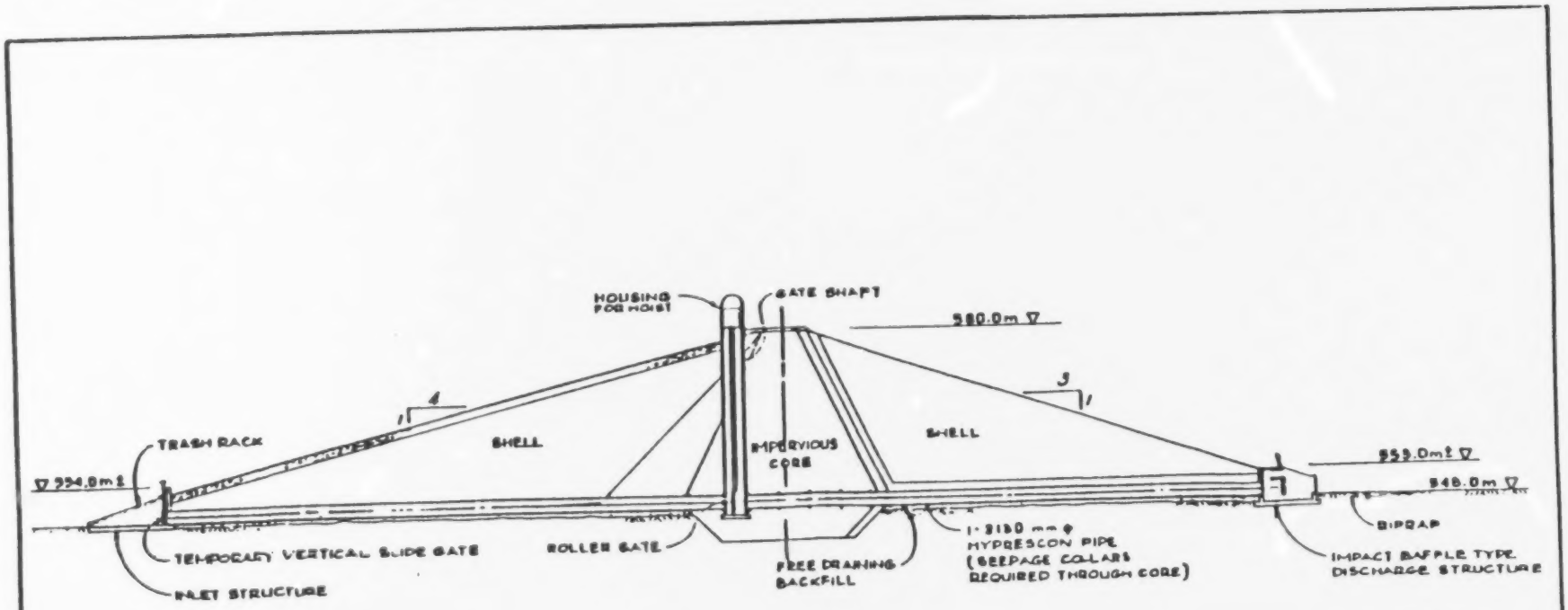


FIGURE 13

ALAMEDA DAM
GENERAL ARRANGEMENT

SOURCE - FENNELL, COCHRANE, LAVALIN - 1985



NOTE : ALL ELEVATIONS ARE IN METRES

FIGURE 14

ALAMEDA DAM CROSS-SECTION THROUGH OUTLET WORKS

SOURCE - FENNELL, COCHRANE, LAVALIN - 1985

b) Concrete Service Spillway

The spillway structure has been sized to pass the 1 in 1,000 year flood of 400 m^3/s with the reservoir at full supply level of 574.0 meters. The chute and stilling basin have been designed to handle the 1 in 10,000 year flood of 650 m^3/s.

The control structure is a simple "ogee" type weir. Control is provided by six 5.5 m x 6.0 m high radial gates. Stoplog slots are provided should inspection and repair of the gates be required.

The stilling basin is a conventional structure equipped with chute blocks and end sill.

c) Low Level Outlet

A low level conduit will be provided for riparian releases and reservoir drawdown. It will have a central gate shaft or well. This conduit will be placed under the dam and will be fitted with a hollow jet or needle valve for low level release.

d) Reservoir

The reservoir will be approximately 24 km long at Full Supply Level. It will have a maximum width of 1.4 km and a maximum depth of 24 m at Full Supply Level.

Since the reservoir will be used for flood storage, the maximum flood elevation will probably be maintained for a longer duration than for other cases. In order to fully utilize the flood storage, the rate of release would be carefully controlled to minimize flooding downstream resulting in a longer retention time.

C. Project Timing

Construction of the Alameda Project is expected to commence spring of 1989 and to be completed by fall of 1990. Because it is not feasible to place and compact fill materials over the winter months, virtually all work will be done over the summer periods.

D. Construction Activities

a) Topsoil

There are four main areas at the Alameda Dam site where topsoil will be disturbed by the construction activities:

- under the main dam fill
- excavation borrow areas for the spillway
- causeway fill areas
- rip/rap harvest areas

The topsoil from under the dam fill will be stripped and stockpiled prior to placing of the fill. This stockpile will have approximately two seasons to dry and will be applied to the slopes of the dam and excavations prior to seeding to grass for erosion protection.

As in the dam construction the topsoil from causeway construction will be removed, stockpiled and subsequently placed on slopes to be seeded to grass.

b) Dust-Proofing Roads

During construction:

All access roads during construction will be gravel surfaced roads. When dust is a problem on the access roads, they will be treated with dust-retardant or wetted down with water to control dust.

After construction:

The main road across the dam will be surfaced with an asphalt surface.

c) Fuel Storage on Site During Construction

Fuel storage on site during construction will be kept to a minimum. On site equipment will be fueled directly from fuel trucks hauling from centres such as Alameda and/or Oxbow.

If any fuel storage is required on site, the fuel would be stored in a conventional fuel storage tank with earth containment dikes around the tank. The volume within the containment dikes would be large enough to hold the contents of a full tank plus an adequate allowance for rainwacer.

d) Flood Routing During Construction of the Dam

Dam construction is scheduled to begin in 1989 prior to the spring flood of that year. Earth cofferdams will be constructed around the main dam fill area and the low level outlet pipe area. A gap in the cofferdams between these two areas will be left to permit passage of flood waters in years 1989 and 1990.

The cofferdam flood channel gap will be sized to handle a 1 in 20 year flood event. Immediately following the 1990 flood period, the cofferdam gap would be closed and the main dam fill would be brought up to full height. Any flood waters after closing the cofferdam would be routed through the completed low level outlet pipe.

During the critical period of spring 1989 and 1990 snow pack will be monitored. If a larger than 1 in 20 year flood is estimated, cofferdams will be raised in areas to protect the uncompleted work.

E. Employment Requirements

The Alameda Project is expected to create approximately 100 person years of employment during the construction phase. A distribution of the labour requirements is as follows:

Total Employment Generated	100 Person Years
By S.B.D.A. & Principal Contractor	80 Person Years
By Others	20 Person Years

Description	Approximate Labour Requirements (Person Years)
Trades (Operators, Carpenters, Labourers, etc)	65
Technical (Engineering, Surveying, etc.)	25
Others	10
	Total 100 Person Years

F. Employment and Business Policies

Wherever possible, contracts will be awarded by the S.B.D.A. through the competitive bidding process to qualified contractors. Successful bidders/contractors will be responsible for hiring their own work force.

Goods and services for the project will be purchased from within the Province and within the Project Area to the maximum extent feasible. Project contractors will be required to comply with corporate policies on:

- preference for Saskatchewan products and services;
- use of local labour; and
- use of Saskatchewan suppliers and sub-contractors.

SUMMARY OF ESTIMATED PROJECT COSTS

	1985 Dollars	1986 Dollars
RAFFERTY		
Dam & Related Structure	$22,800,000	$23,940,000
Land	6,670,000	7,004,000
ALAMEDA		
Dam & Related Structures	27,000,000	28,350,000
Land	4,200,000	4,410,000
ENGINEERING & ADMINISTRATION	5,100,000	5,355,000
MITIGATION		
Transportation	11,549,000	12,126,000
Fisheries	619,000	650,000
Wildlife	3,609,000	3,789,000
Archaeology	1,238,000	1,300,000
Recreation	3,705,000	3,890,000
Mainprize Park	1,638,000	1,720,000
Power Lines	857,000	900,000
Water Supplies	405,000	425,000
Reservoir Clearing	380,000	400,000
OIL WELLS & PUMPSTATIONS		
Rafferty	17,300,000	18,165,000
Alameda	3,860,000	4,053,000
DIVERSION CHANNEL	9,070,000	9,524,000
TOTALS	$120,000,000	$126,001,000

Note: To Convert to 1986 Dollars = 1985 Dollars x 1.05

PLANNING CONSIDERATIONS

Since completion of the feasibility analysis which indicated that the Rafferty/Alameda Project was viable and which led to the conditional approval to proceed, the Souris Basin Development Authority has established an extensive planning framework for the Project. Achievement of the various project objectives required the integration of a number of considerations within the Authority's planning process. Chief among these has been recognition of the competitive scenario that confronts demand for scarce water resources and optimal application of those resources.

The Authority also recognized that the Environmental Impact Assessment process could serve as a key planning tool in articulating what the Project was, what its impacts would be, what mitigation could be achieved and what necessary trade-offs were proposed. As a multiple-objective project, it is difficult to examine other alternative projects which, singly, would fulfill all of the same purposes. The Environmental Impact Assessment process and the Statement in particular, provides the opportunity for the Authority to explain the rationale for the various components of the Project.

Pre-dating the establishment of the Authority, was the effort to attempt to resolve specific water management problems in the Souris Basin. Answers were found for such questions as whether or not floods, which were currently being experienced, could be minimized. Could the recreational needs of southeastern Saskatchewan residents be better satisfied? Would there be sufficient water to irrigate sizable blocks of land and to satisfy the Saskatchewan Power Corporation's requirements for the proposed Shand Power Station? This document demonstrates that the answers to all these questions are in the affirmative.

The recognition of the need for a comprehensive Souris Basin water management plan has been a key element in the planning process. This initial effort has been based on the identification of the overall social and economic development objectives for the area. Fundamental to the analysis has been the illustration of how water resources and land capacity can best be managed to further these objectives while maintaining an environmentally responsible Project. A critical area of study has been the long-term impact that the Project will have on agriculture in the Study Area.

Much public attention has been focused on the short-term or immediate impact that the Rafferty/Alameda Project will have on agriculture. Some of this attention has been the result of efforts on the part of various special interest groups formed to oppose the construction of the Rafferty/Alameda Project. Although none of these groups have initiated any direct contact with the Authority, their publicly stated concerns have been addressed and major steps taken to minimize the impact of the Project on agricultural land. The most graphic example of this is illustrated by the effort the Authority has made to reduce the amount of land required for the Rafferty Reservoir in order not to inundate community pasture land, particularly in its upper reaches, and still be able to fulfill all of the objectives of the Project. Flood easements will be used instead of acquisition as was originally planned, on all lands (with a few exceptions) above the Full Supply Level up to the Maximum Controlled Flood Level. In this way, landowners will be able to continue to own their land and to continue their operations except in those infrequent and temporary major flood events when the reservoir surcharge capacity is utilized. There should not be an inordinate amount of disruption in such flood years on those areas where flood easements have been entered into as these lands would likely have been flooded in any event.

Initial Power Corporation plans called for the first 300 MW unit at the Shand Power Station to be water-cooled and the second unit to be air-cooled. More detailed planning on the Rafferty/Alameda Project has permitted the allocation of sufficient water from the Rafferty Reservoir to permit the second unit to be water-cooled as well.

According to SPC, current plans are to utilize this additional water from the Rafferty Reservoir along with effluent from the City of Estevan Sewage lagoons and water from mine de-watering in the coal spoil areas in order to provide coolant for the second unit at Shand. Water will be conveyed from the Rafferty Reservoir by way of pipeline along the floor of the Souris Valley via the Estevan Sewage lagoons to the Shand Power Station.

SPC has assured the Authority that its plans are to avoid having any return flows into the Souris River from the Shand Power Station (ie no "blow downs") thus avoiding considerable potential downstream water quality and environmentally related problems.

The third type of planning activity to which the Authority is committed is an integrated resource development plan based on environmental, social and economic development goals already established for the area. The Authority recognizes that a long-term strategic framework for the wise use of all natural resources, including water, within the Souris Basin must be developed. It is with this recognition in mind that the Authority acknowledges the future need for a management authority for the Basin, as a first step after these projects are constructed, to ensure that future development is carried out in an orderly and rational manner.

As a complex multi-purpose project with long term water and land management implications, attention must be given to the development and implementation of an integrated basin management plan. The elements of such an overall plan involve the reservoir operating plans, wildlife enhancement and mitigation plans, fisheries management plans, downstream ecosystem protection and management, land uses and administration and responses to social and economic needs of the people in th basin as well as longer term contingencies which may develop. Many of these elements will be in place following completion of the projects, but there will be a continuing need to integrate these elements over the long term.

There are many concerns of interest groups and legislated agency responsibilities which must be brought together in the planning process. These include local interests by landowners and the municipalities involved and special interest groups such as the Saskatchewan Wildlife Federation, Ducks Unlimited Canada and the Saskatchewan Natural History Society. In addition to the Souris Basin Development Authority's initial short term mandate, provincial responsibilities are represented by the Saskatchewan Water Corporation, Saskatchewan Environment, Saskatchewan Agriculture, Saskatchewan Parks, Recreation and Culture, the Saskatchewan Power Corporation and others. With such a diversity of interests and responsibilities, development of a long term integrated basin management plan will take time, effort, cooperation and understanding. The task is neither simple nor quickly completed but it is necessary,achievable, and very worthwhile.

As indicated in the Land Use section of this Statement, it is suggested that Reservoir Development Areas should be established around the Rafferty and Alameda reservoirs. Future inclusion of the Boundary Reservoir on Long Creek would also be appropriate to achieve greater uniformity in dealing with the overall Souris Basin management objectives. The existing Boundary Reservoir would appear to be a good

example of the results of no overall management plan. There is confusion amongst the public as to the responsibilities of Saskatchewan Power Corporation, Saskatchewan Parks, Recreation and Culture, Saskatchewan Water Corporation, the Rural Municipality of Estevan and the Estevan District Planning Commission. Responsibilities for land and water use controls and development around the reservoir are not clearly defined.

This Environmental Impact Statement has attempted to identify and deal with the potential environmental and economic impacts of the Project. Specific mitigation plans have been described in the wildlife, fisheries, land use, mineral resources, transportation, recreation, heritage resources and other sections. Short term and long term monitoring requirements are also addressed. As the Authority's current mandate is limited to the planning, design and construction of the dams, reservoirs and related appurtenances, many of the monitoring and mitigation efforts must become the commitments of a subsequent responsible agency. An administrative body with longer term responsibilities must follow this current mandate of the Authority. It would be inappropriate to specify the structure of such a subsequent administrative body at this time without the direct input of the local municipalities, interest groups and other government agencies. Creation of such a body must necessarily follow the decision to proceed with the Project and follow through with the various mitigative and monitoring activities. Clearly it must become the responsibility of an agency with a long term mandate to integrate the reservoir operating plans, the various mitigation plans, land use controls, and public and private developments into a comprehensive Souris Basin Management Plan. The purpose of the plan will simply be to integrate predicted water demands and flood control requirements with optimal ecosystem management and optimal economic development in the Saskatchewan portion of the basin area. At this point in time, the Authority can do no more than recognize these long term needs and, as proponent of the Project on behalf of the government, commit the government to developing an appropriate administrative body which will adequately respond to these needs.

As a matter of historical interest, it is noteworthy that in 1949 the Government of Saskatchewan passed the Conservation and Development Act to provide for basin authorities to "conserve, develop and utilize any land and water resource on a watershed basis. An Authority has been set up in the Souris River Basin for such development" (Government of Saskatchewan Submission to JJC Reference 1955).

This is the only reference that could be found regarding the establishment of such a special purpose body.

Insofar as area residents are concerned, the Authority is of the view that public involvement provides the cornerstone for all planning activities. The position of the Souris Basin Development Authority and of the Government of Saskatchewan is that people have an intrinsic right to express their views, on issues in general and, in particular, on a project such as this which will have a major impact upon their community. Numerous examples already exist where the views of area residents and interested parties have been integrated into the plans for the Project. One of the best examples of this is advice and guidance provided by members of the Estevan Chapter of the Saskatchewan Wildlife Federation whose valuable recommendations have been incorporated in planning mitigation of negative Project impacts on wildlife habitat.

The Authority recognizes that those who have spent their entire lives in the Souris Basin possess valuable of expertise which can be usefully applied to the planning process. To this end, the Souris Basin Development Authority has committed itself to a public involvement program committed to taking the views of the public into account.

REGULATORY REQUIREMENTS

The following are licenses and approvals required before construction of the Rafferty/Alameda Project can commence:

I. Saskatchewan Environment License

As project proponent, the Souris Basin Development Authority is required to conduct an environmental impact assessment of the development and to prepare and submit to the Department of Environment, an Environmental Impact Statement relating to the development. When the Minister of Environment is satisfied that all requirements of the Environmental Assessment Act have been met (in this case including public hearings), he shall give ministerial approval to proceed with the development and may impose any terms and conditions he deems necessary.

II. Saskatchewan Water Corporation License

The proponent must file a completed application and acceptable plans of the project with Saskatchewan Water Corporation (Sask Water). The Minister responsible for Sask Water has up to 45 days to comment on the project. The application should be prepared and approval granted before construction begins. Primary consideration will be given to the safety standards built into the dams and the ability of the Operating Plan to satisfy Saskatchewan's obligations and interests.

III. International River Improvements Act License (Federal)

This Act is administered by Environment Canada. A license is required under this Act and would likely be for a 35 year period. There could be conditions placed on the license relating to any flow related issues including such things as water quality objectives or special water quality monitoring.

When the application is made, Saskatchewan will have to provide:

- The Environmental Impact Statement.
- Information on the operating plan, including the relevant parts of any agreement with the United States. This is to ensure that Canada can satisfy itself that there will be no problems in apportionment.
- The status of other approvals, particularly the provincial approvals.

Because these items are not yet available, it is too early to submit the application. However, the licensing matter was recently discussed with Environment Canada and assurances were received that they would expedite the process when a formal application is received.

IV. External Affairs

Close consultations with External Affairs have been maintained regarding the progress on the negotiations with the United States. Once agreement has been ratified by the two negotiating teams on such matters as the Operating Plan, Operating Agreement and Financing (expected by Summer 1987), duplicate copies will be sent both to the Department of

External Affairs and to the U.S. State Department. These agencies will then exchange diplomatic notes to render the various agreements enforceable.

V. International Souris River Board of Control

This Board would likely want to study the project. The Board will not likely refer the project to the IJC as the construction and operation of these facilities will not have an impact on apportionment.

VI. United States Regulatory Requirements

Given the transboundary nature of the Project, the Army Corps of Engineers is required to satisfy a number of environmental requirements in the U.S. The following is a summary of the requirements.

The proposed project fully complies with applicable environmental protection statutes and Executive Orders for the current stage of planning. Environmental statutes and Executive Orders important to the decision on this project include the National Environmental Policy Act of 1969, the Water Resources Planning Act of 1965, the Fish and Wildlife Coordination Act of 1958, the Endangered Species Act of 1973, the Land and Water Conservation Fund Act, the Archaeological and Historic Preservation Act, Executive Order 11988 on Floodplain Management, Executive Order 11990 on Protection of Wetlands, and Executive Order 12114 on Environmental Effects Abroad of Major Federal Actions.

The proposed action also complies with Section 404 of the Clean Water Act as a result of analyses conducted for the Lake Darling 4-foot raise project and water quality certification received from the State of North Dakota. The proposed plan differs from the Lake Darling project in that it eliminates the requirements to place fill in some areas (e.g., Dam 41), and would require placement of less fill in other areas (e.g., Lake Darling Dam). It does not require placement of fill material in any additional areas and is therefore in compliance with the Act.

VII. Area Municipalities

The project will have a variety of impacts on a number of municipalities in the area. These municipalities have various regulatory requirements (such as zoning approvals, development and building permits). Immediately upon Project approval, application will be made to all affected municipalities for the applicable required approvals.

GLOSSARY

Cofferdam - A temporary dam built above the ground to exclude water and thus give access to an area which is ordinarily submerged or waterlogged.

Cudams (dam^3)- Cubic decametres (0.8 acre-feet, 35,314 cubic feet, or 219,969 gallons). One cubic decameter = 10 m x 10 m x 10 m = 1,000 cubic metres.

Emergency Spillway - Spillway designed to handle any floods up to the probable maximum flood which has a probability of occurrence of 1 in 10,000 years.

Full Supply Level - The maximum level at which the reservoir will normally be operated.

Initial Operating Level - Maximum elevation (549.5 m) at which the Rafferty Reservoir will be operated until such time as certain oil wells will have been exhausted and properly abandoned. This will result in lower oil well mitigation costs.

Maximum Flood Level - Maximum elevation of the reservoir before overtopping of the dam unless the emergency spillway is activated.

"Ogee" - A curved weir, built between each pass of spillway piers, which raises the level of the water in the reservoir before the water flows over the spillway when the gates are in the raised position.

Service Spillway - Spillway designed to handle any floods with a probability of occurrence of 1 in 1,000 years.

Wick Drains - Small, relatively flat, (approximately 100 mm x 5mm), continuous perforated drains which conduct water upward by excess hydrostatic pressure and so accelerate the dam foundation consolidation process. Wick drains will be installed throughout the clay zone on the floor of the Souris Valley beneath the base of the Rafferty Dam.

APPENDIX ONE

Mandate of the Souris Basin Development Authority

On February 12, 1986, Premier Devine announced that, subject to U.S. funding approval (of their commitment to contribute $41.1 Million U.S. in October, 1985 $) and compliance with all environmental and regulatory requirements, the Saskatchewan Government intends to build the Rafferty and Alameda Dams on the Souris River system.

The project being proposed is multi-purpose in nature with several Government Departments, Agencies, and Crown Corporations having varying degrees of involvement. In order to ensure that the construction of the two dams is completed on time and within budget and that all of the multi-purposes and interests are addressed, the Government created a new Crown Corporation, the Souris Basin Development Authority. It was established by Order in Council #270/86 passed on March 6, 1986.

The mandate of this Authority is to coordinate and manage the design and construction of the projects. It will enter into agreements with other appropriate Government Departments, Agencies, and Crown Corporations for expertise and/or staff, as follows: Saskatchewan Power - for engineering, construction and project management; Saskatchewan Water Corporation - operation and ownership; Energy and Mines - oil well mitigation; Parks & Renewable Resources - Park development, Regional Park relocation, wildlife habitat replacement and general recreation.

The Board of Directors of the Authority is as follows:

E. Berntson - Chairman, Minister in Charge

G.D. Hill - Vice-Chairman, President and Chief Executive Officer of Souris Basin Development Authority

D. Stankov - Chairman, Saskatchewan Power Corporation

V. Fowke - President, Saskatchewan Water Corporation

E.B. Campbell - Regina

R. Henders - Estevan

G. Ross - Estevan

R. Young - Alameda

The Head Office of the Authority is 814 - 4th Street, Estevan, Sask.

It is intended that on completion of the projects, the two dams would be turned over to Saskatchewan Water Corporation for operation and ownership and the Authority as it is currently constituted, will cease to exist. To this end, the Authority, as an agent for Saskatchewan Water Corporation, will acquire the assets and lands required for the project with title to the assets and lands being registered in the name of the Saskatchewan Water Corporation.

The Authority has an agreement in place by which Saskatchewan Water Corporation provides the following services relative to the project:

a) advice and assistance with respect to licences, approvals and the like, required for the Project, including the preparation of documentation and acting as a joint applicant, if necessary, given that Saskatchewan Water Corporation will be the ultimate owner and operator of the Project;

b) handle interjurisdictional matters in co-operation with the Authority and the Executive Council, including dealing with International Joint Commission issues and concerns of the Province of Manitoba as may arise;

c) in consultation with the Authority, negotiate an operating agreement with the appropriate United States authority in relation to the operation and maintenance of the Project;

d) provide advice and assistance with respect to water matters, or other matters on which Saskatchewan Water Corporation has expertise, which arise in relation to the Project;

e) such other services to be agreed upon by the Authority and Saskatchewan Water Corporation.

The Authority also has an agreement in place by which Saskatchewan Power Corporation provides to the Authority project management services, engineering services, construction management services, and land acquisition services in relation to the project including:

a) preparation of any necessary preliminary studies;

b) preparation of preliminary estimates of the Project and monitor the total Project costs on a monthly basis, including global costs in respect to work done by other departments or agencies;

c) prepare and define a project schedule and monitor progress of the project on a monthly basis, including global costs in respect of project work done by other departments or agencies;

d) preparation of working drawings and specifications;

e) preparation of forms of tenders, proposals, and contracts and advising on tenders and proposals;

f) advising on the selection of contractors, suppliers, and engineering or other consultants;

g) instructing and monitoring progress of such contractors, suppliers, and consultants;

h) furnishing to contractors, consultants, suppliers, or others who may reasonably require them, such copies of the contract drawings and specifications and such large-scale and full-size detailed drawings as are necessary for the proper carrying out of the Project;

i) checking of shop drawings;

j) authorizing the issuance of certificates for payments and passing and certifying accounts for payment by the Authority;

k) construction and contract administration services, including coordinating activities of contractors, suppliers, consultants, and others of Saskatchewan Power Corporation or the Authority and handling of disputes and claims against Saskatchewan Power Corporation or the Authority;

As well, give the obvious inter-relationships between the Shand Power Station and the Rafferty/Alameda Project, close on-going consultation has taken place between the Authority and SPC in ensuring that the Projects are closely co-ordinated.

l) post-construction services, including conducting a final Rafferty and Alameda Dam Project review and advising as to continuing or newly-observed defects or deficiencies;

m) establish a dam safety monitoring program;

n) field services, including site inspection and supervision;

o) land acquisition services, including negotiation of purchases and effecting transfers of title;

p) such other services as are agreed upon by the Authority and Saskatchewan Power Corporation.

Construction of the Rafferty Dam is scheduled to begin in 1988 with the Alameda Dam to follow in 1989.

APPENDIX 2

PROJECT SPECIFIC GUIDELINES FOR THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT

SOURIS BASIN DEVELOPMENT AUTHORITY
ALAMEDA DAM AND RESERVOIR
RAFFERTY DAM AND RESERVOIR

August, 1986

1.0 INTRODUCTION

These guidelines have been prepared to assist the Souris Basin Development Authority in preparing an Environmental Impact Statement (EIS) for the proposed Alameda and Rafferty Dams on the Souris River system. The proposed Alameda Dam and Reservoir will be located on the Moose Mountain Creek approximately 15 km northwest of Oxbow; the proposed Rafferty Dam and Reservoir will be located on the mainstem of the Souris River approximately 10 km north west of Estevan.

The guidelines include the most important concerns and information which have been identified by Saskatchewan Environment and the Environmental Assessment Review Panel, as being required for the EIS. It should be noted that further concerns and data requirements may arise during investigations associated with the Environmental Impact Assessment and that requests for additional information may be put forward by Saskatchewan Environment.

2.0 DEVELOPMENT AND OPERATIONAL DETAILS

A complete description of the proposed developments is essential as a basis upon which to judge impacts. This should include a map which shows the exact locations of anticipated structures and contour lines indicating various reservoir levels. Timing of water use and related reservoir fluctuations should be indicated.

3.0 WATER QUALITY AND QUANTITY

3.1 Souris Basin Development Authority should predict future water quality, including eutrophication effects, at the U.S. border. Predicted effects should be compared to present conditions. Seasonal effects and the effects of unusual conditions such as droughts and floods on water quality should be predicted in relationship to changes caused by the projects.

3.2 Soils in the potential reservoir area should be sampled for nutrients and mercury before the project goes ahead. The effects of the project on the concentrations and dispersion of these constituents should be estimated.

3.3 Ground water quality, quantity and movements in the potentially affected area should be delineated (based upon existing groundwater data).

3.4 The existing and historic situations with regard to water quality, quantity, flow rates and regimes in relation to the seasonality and municipal and agricultural uses and discharges should be described in detail.

3.5 Estimates of future water needs of relevant communities, irrigation farming, and industry should be provided. These should be related to seasonal and abnormal fluctuations in water supply further related to expected changes caused by the reservoir.

3.6 Flooding potential before and after reservoir construction should be outlined, including descriptions and comparisons of means of coping with flooding in both situations.

3.7 Data should be provided on the capacity of reservoir and river waters to accommodate potential municipal effluent and agricultural and industrial wastes.

3.8 Present use of river water, including consumption and location, and amount, timing and location of effluent discharges should be described.

4.0 AGRICULTURE AND LAND USE

4.1 The agricultural land classification and potential of the lands involved should be described.

4.2 A detailed description (including a map) of the land use in the potential affected area should be provided. The description should include economic activities and recreational uses. Location of producing oil wells should be indicated.

4.3 The potential influence of the reservoir on irrigation farming should be evaluated.

4.4 Information should be provided on the anticipated quality of reservoir and river water in relation to whether or not it will still be usable for market gardening and cereal crop irrigation purposes.

5.0 ARCHAEOLOGY

5.1 Archaeological resources in the area are usually important due to the fact that different cultural groups and bison herds mixed freely in the Souris River region during early historic times.

Saskatchewan Culture and Recreation requires that the following archaeological impact assessment work be carried out:

(a) A complete archaeological survey of the proposed dam sites are necessary.
(b) Judgmental surficial and subsurface inspection of high potential zones and systematic or random survey of the anticipated reservoir should be carried out. Further, such work may be required on the basis of the results obtained during the first field season.
(c) An assessment is necessary of the archaeological potential of borrow areas and other off-site facilities which will disturb the soil surface.

6.0 WILDLIFE, FISH, AND HABITAT

6.1 Detailed habitat maps of the potentially affected areas should be provided. These maps should be accompanied by evaluations of habitats with regard to use by economically, and recreationally important and rare or endangered species. Critical habitat should be identified, and its importance on a regional scale should be evaluated.

6.2 Wildlife inventories of the potential reservoirs should be conducted so as to obtain species, numbers, and locational data, as well as, intensity of use related to seasonality and for special purposes (e.g. sharp-tailed grouse dancing grounds and colonial bird nesting sites).

6.3 A inventory of fish species and populations should be conducted. In addition, spawning sites and other important fish habitat should be identified. Use of existing aquatic habitat for recreational fishing should be delineated.

6.4 Floristic inventories of the potentially affected areas should be conducted, identifying plant species, including rare and endangered species, and outlining ecological zonation and processes normal to the area.

6.5 The EIS should identify potential impacts on wildlife and habitat by possible reservoir associated developments and activities such as irrigation, cottages, and recreational activities. The EIS should also identify impacts which wildlife (e.g. waterfowl) associated with the

proposed reservoir could have on adjacent agricultural production.

7.0 PREDICTION, EVALUATION, AND MITIGATION

7.1 Predicted environmental and socio-economic changes should be stated in both quantitative and qualitative terms as they relate to data on existing environmental and socio-economic situations.

7.2 The predicted bio-physical changes should be evaluated in relation to the present state of the environment, including ecological processes, land uses, and economic and recreational activities.

7.3 Based on the data and evaluation provided by the EIS, a detailed mitigation plan should be provided, including the costs of implementing the plan.

8.0 SOCIO-ECONOMIC CONCERNS

8.1 The existing labour force and important economic activities should be described and contrasted to the expected situation during and following reservoir construction.

8.2 A detailed map should be prepared delineating roads with present river crossings which will be eliminated by the reservoir. Compensatory programs should be indicated for the following: Dr. Mainprize Park, Lutheran Bible Camp, wildlife habitat, and oil wells.

9.0 PUBLIC INVOLVEMENT

9.1 The concerns of farmers, local land owners, and other local people should be documented and considered in the evaluation process